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Creating, sharing and reusing learning objects to enhance information literacy

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Abstract

From June 2010 until the present, a suite of online reusable learning objects (RLOs) has been created by staff at the Institute of Technology Tallaght (ITT Dublin) library covering a range of information literacy (IL) competencies. These RLOs have helped to facilitate student transition from second to third level, advance IL and enrich the student learning experience.

The purpose of this paper is to outline the development of these RLOs and how the resources have been shared, reused and repurposed to enhance IL progression. A review of recent literature explores some of the key issues around the creation of digital learning resources and best practice, as well as the pedagogical foundations on which the learning objects are built. The design, development and implementation of the RLOs and the collaborative working arrangements that the digital resources have helped to foster are also outlined and the authors examine the issues and challenges experienced by the project team during the course of the RLO development.

The significant usage and substantial impact that the learning objects have had on student-centred education and the various evaluative mechanisms used to measure the effectiveness of the RLOs is discussed, as well as future development plans. These learning tools have promoted best practice in innovative delivery methods and added value to the wider higher education (HE) community in the Republic of Ireland through their sharing, dissemination and reuse as open educational resources (OERs) via the National Digital Learning Resources (NDLR) service.

The paper is likely to be of particular relevance to academic library practitioners and teaching staff in Irish HE as it provides an overview and links to a suite of digital learning tools that can be used or adapted in other academic settings. In terms of originality, there is no evidence of any published literature within the context of Irish HE sector covering the development of RLOs to support IL initiatives and will inform future research on how learning objects can be used to support learning and teaching practice both in the Republic of Ireland and further afield.

This article is based on a poster presentation at LILAC 2012.

Keywords

information literacy, digital learning objects, open educational resources, online learning, blended learning, higher education, academic libraries, Republic of Ireland

1. Introduction

This paper provides an overview of the creation of reusable learning objects (RLOs) at the Institute of Technology Tallaght (ITT Dublin) and how the development of these digital learning tools has helped to facilitate successful student transition to higher education (HE), improve information literacy (IL) skills and enhance the student educational experience.

These RLOs take the form of short online tutorials and cover topics such as research, retrieving and evaluating information, referencing and plagiarism. Entitled *How To*, the resources are robust interactive learning tools which empower the learner and provide them with 24/7 self-directed learning. They adhere to a constructivist philosophy and facilitate student learning in an active and engaging manner; learners are also provided with opportunities to develop, reflect on, and assess their progress, as they acquire an independent approach to learning.

The RLOs have been developed so that they can be shared, reused and adapted for an array of learning environments (including face-to-face, blended and online) both in ITT Dublin and in the wider HE community via the National Digital Learning Resources (NDLR) service where they are hosted as open educational resources (OERs) under a Creative Commons (CC) License.

1.1 Background / institutional context

ITT Dublin is the sole third-level academic institution in South Dublin County and has a student population of over 4,000 students (full-time and part-time), offering a ladder of qualifications from Higher Certificate to Masters and Doctorate level across a wide range of programmes in the areas of: Business; Humanities; Engineering; Science; and Computing. The library at ITT Dublin has over 5,200 registered library users. The library's approach to IL development is very much a student-centred model where deep learning is facilitated and students are continually active through participation and meaningful engagement.

The NDLR is an online repository in the Republic of Ireland which promotes and supports the creation and sharing of OERs amongst Irish HE institutions. Funded by the Higher Education Authority (HEA), this national service encompasses universities and institutes of technology. This repository of RLOs is organised into discipline areas known as Communities of Practice (including IL). The NDLR, which was integrated into a National Forum for the Enhancement of Teaching and Learning in November 2012, provides funding to the academic community to develop OERs via local and national funding mechanisms.

2. Literature Review

The literature review indicates the many issues that need to be considered when approaching the task of designing e-learning resources, especially those which are to be reusable across a wide range of educational environments, disciplines, levels of study and institutions. These include: pedagogy; signalling learning intent; student interaction, assessment and appropriate evaluative mechanisms. This review examines the literature surrounding these concepts. The authors also explore best practice examples of learning objects and online repositories from Ireland, the UK and the US.

In terms of boundaries, the literature review focused on searching and retrieving journal articles for the last ten years from library, information science and education publications using online subscription databases such as Business Source Complete (EBSCO Publishing), Emerald Management Xtra (Emerald Publishing) and Science Direct (Elsevier). Recent monographs were also reviewed for up-to-date content on new online learning models for IL.

The literature on web-based library instruction, online IL tutorials and RLOs is extensive but less so within an Irish context. Various searches on learning objects, open educational resources and IL specifically related to Ireland yielded very little.

2.1 Pedagogical approach

The project team was determined to design RLOs that were flexible and could be used in a variety of instructional settings. Learning objects can be employed in synchronous and asynchronous modes; as standalone resources or within module or course syllabus; and applied in face-to-face, blended and online classes (Blummer and Kritskaya 2009; Mardis and Ury 2008).

The design of any learning resource, particularly OERs, must conform to sound pedagogical principles and consider different learning styles and approaches (Mackey and Jacobson 2011; Kammerlocher et al. 2011; Wales and Robertson 2008). The considerations include: signalling learning intent through clear learning objectives and outcomes; the use of standards to guide the development of the resource; the encouragement of effective collaboration where appropriate; fostering the use of active learning approaches; and the use of appropriate assessment techniques (Blummer and Kritskaya 2009).

2.2 Constructivism

In designing these RLOs, the project team was aware of the need to ensure that the tools were grounded in best practice instructional design and online pedagogy. Some design aspects of online tutorials stem from a behaviourist approach. These include the use of strong and varied stimuli, careful planning and the sequencing of learning events, and specifying achievable and verifiable learning objectives in the form of learning outcomes (O'Neill et al. 2005, p.15). The developers therefore designed the RLOs to be used in context. Students were taught to use the tutorials at the same time as they were asked to complete a research assignment for their discipline. As students then asked questions about how to start the research task, how to search the web or library catalogue, they were encouraged to complete the tutorials. This approach encouraged the use of higher-order cognitive skills such as critical thinking, problem solving and reflective learning as they explored the tutorials and topics they were studying. The use of the tutorials just prior to or during a relevant research based assignment emphasised a constructivist approach to course design which encourages learners to construct their own learning through activities and tasks that are matched to the intended learning outcomes of the course (Mackey and Jacobson 2011).

2.3 Constructive Alignment

One way to encourage learners to engage with a unit of learning in a meaningful way is to use the principle of Constructive Alignment (Biggs 1999, cited in O'Neill et al. 2005 p.102). Biggs' theory of constructive alignment emphasises the importance of ensuring the alignment of learning outcomes, the instructional medium, and the assessment methods throughout the learning process. This approach of alignment in designing a learning experience can encourage deep engagement from learners. During the design phase of the ITT Dublin IL tutorials, emphasis was placed on ensuring a strong interrelationship between each of these elements. It is important to note that the tutorials do not exist in isolation; they are part of an IL programme embedded in teaching modules and now in *Learning to Learn* modules in each of the academic departments. So alignment exists between ITT Dublin's IL framework; the learning outcomes of each of the modules where the tutorials are used; the activities used to develop a student's knowledge and skills; the assessment used to evaluate the students; and finally the tutorials that support these activities and assessment.

Table 1 – Constructive Alignment in ITT at module and tutorial level

	Learning Outcomes	Learning Activities	Assessment
Module Level	<ol style="list-style-type: none"> 1. Write a research-based report and make an effective presentation. 2. Recognise the importance of academic integrity and identify ways of avoiding plagiarism in academic work through appropriate referencing. 	Project or group project, including a written research-based report, presentation and appropriate referencing.	A rubric was developed that emphasised the following aspects of the work: the presentation/formatting of the report; grammar and spelling; appropriate sources used; number of sources; citation and referencing style.
Tutorial Level	<ol style="list-style-type: none"> 1. Create a research strategy for your assignment. 2. Demonstrate an understanding of how to cite and reference 3. Explain how to avoid plagiarism 	Online interactive exercises outlining effective search strategies, identification of academic sources and referencing of sources using an appropriate citation style.	Formative assessment including reflective activities. Online quizzes. Online feedback form.

2.4 Diversity in learning

Another underlying principle of constructivism is the emphasis it places on diversity in learning, due to the varying perception or understanding of the world held by learners (O'Neill et al. 2005). Theories of learning styles or types claim that there are clear learner preferences which are influenced by prior learning, by habit, or the learner's own strengths. There are many different learning style models. A popular model is that based on personality constructs (Myers-Briggs, 1980, cited in O'Neill et al. 2005 p.19). The VARK model is based on visual, auditory, read-write and kinesthetic modalities (Fleming and Mills 1992, cited in O'Neill et al. 2005 p.19). Kolb's model (Kolb 1984, cited in O'Neill et al. 2005 p.14) emphasises learner preferences for specific stages of the learning cycle. Gardner's theory of multiple intelligences (Gardner 1999, cited in O'Neill et al. 2005 p.20) claims that individuals have a variety of intelligence types, including linguistic and logical-mathematical, rather than a single overarching intelligence. Learning style theories recommend the designer of a learning experience adopts a range of instructional approaches in order to cater for diverse learning preferences and to allow learners to work to their strengths.

The online tutorials have been designed to cater for diverse learning styles. The tutorials provide navigational flexibility as learners can work through topics in the tutorial in the predefined sequence or they can enter and exit the tutorial at any point. The tutorials are self-paced so the learner can spend as long as they require at each section, pausing or repeating content where appropriate. There is strong emphasis on the use of visuals, such as images and video.

The literature supports the use of online learning tools to provide IL educators with a range of delivery modes to engage a diverse range of students with varied learning styles, offering a valuable mechanism for supplementing traditional face-to-face IL instruction (Thornes 2012; Su and Kuo 2010; Kendall et al. 2007).

2.5 Active learning

The online learning experience these tutorials offer has been designed to foster active learning. The literature highlights the importance of learning objects in terms of active student engagement, enriching the student learning experience, facilitating self-directed learning and offering students 24/7 self-paced online support at point-of-need (Mackey and Jacobson 2011; Keown 2007; Littlejohn 2003).

Active learning is a term that stems from the constructivist approach to instruction and course design (Mackey and Jacobson, 2011). Bernard et al. 2009, (cited in Mackey and Jacobson, 2011) claim that active student-centred learning contributes to high student achievement. Activities included in the learning experience must be relevant and stimulating (Webb and Powis 2004).

2.6 Assessment

Assessment is the part of the learning task that challenges students to assess how their acquired knowledge and skills compares against a model of that knowledge or skill. In order to challenge existing knowledge constructs, this assessment must comprise of both summative and formative elements that help students understand how they were wrong and how they can improve (Franke-Wikberg and Lundberg 1985; Stenhouse 1975, both cited in Skagen et al. 2008 p. 94).

The quizzes at the end of each section of the tutorials were designed to consolidate understanding of key concepts and reinforce learning. On completion of the quiz, students receive a grade. The quizzes also facilitate formative assessment by providing immediate feedback through the provision of the correct answer, suggestions for improvement, or links to further assistance. Engagement in the assessment tasks is encouraged through the use of a variety of question types including: true or false; multiple choice; fill in the blank; word bank; matching drag and drop; and sequence drag and drop.

The use of these tutorials just prior to, and during, research and writing tasks related to their field of study motivates students to learn how do research, reference and avoid plagiarism and then apply their new knowledge and skills immediately.

2.7 Collaboration

A significant challenge that the developers faced was the steep learner curve for staff who were not e-learning developers. The literature underlines the importance of close collaboration in terms of leveraging existing skills and expertise on campus, pedagogical support and online course design (Mestre et al. 2011; Ward 2010). The ITT project team proactively engaged academic staff and educational technologists on campus to ensure the design of pedagogically-sound learning objects. Miller and Bell highlight the value of a collaborative approach to online IL instruction (2005, p.136): “the success of online education particularly at graduate level requires active, deliberate and sustained collaboration amongst all stakeholders: administrators, faculty, instructional designers, librarians, technology specialists, and students”.

2.8 Learning objects

Small units or chunks of digital educational material have come to the fore as resources to facilitate flexible self-paced learning and are considered scalable and adaptable in terms of supporting a diverse range of learners. Reuse is an important feature of these learning tools and this is supported by Kammerlocher et al. (2011 p.392): “small discrete learning objects that can be reused

in a variety of disciplines or learning environments have emerged as a significant approach to e-learning”.

Wiley’s definition of learning objects holds particular significance for the ITT project team; they are defined as “small (relative to the size of an entire course) instructional components that can be reused a number of times in different learning contexts” (Wiley 2000, p.3). The developers also endorsed Johnson’s definition of a learning object - “a collection of digital materials — pictures, documents, simulations — coupled with a clear and measurable learning objective or designed to support a learning process” (Johnson 2003, p.4). These reusable learning tools can be shared online as open educational resources (OERs) under an open licence for example Creative Commons. OERs are defined by JISC as: “teaching and learning materials that are freely available online for everyone to use, whether you are an instructor, student or self-learner. Examples of OERs include: full courses, course modules, syllabi, lectures, homework assignments, quizzes, lab and classroom activities, pedagogical materials, games, simulations, and many more resources contained in digital media collections from around the world”.

Mestre et al. (2011) make the point that tutorials are the most frequently produced learning objects in libraries, with many produced via screen-casting software. The project team evaluated screencasting tools to develop the RLOs including Camtasia and Captivate, eventually deciding upon the commercial software Articulate Studio 9 as the primary development tool with the research indicating its enhanced functionality and the limited technical knowledge which was required to produce effective, professional looking resources. Thornes (2012) discusses the award-winning Leeds University Library suite of online tutorials which were created using Articulate, highlighting the merits of the software as an easy-to-use, flexible and intuitive tool for generating e-learning content.

In a 2012 survey focused on the sharing of IL teaching materials as OERs, Graham and Secker (2012) found that current practice amongst many librarians creating digital resources is to find existing learning materials before developing their own. The ITT project team reviewed existing educational resources at local level but found that there was lack of materials that could be reused and adapted. Research at national level via the NDLR and other channels indicated that there was a similar dearth of relevant and high-quality digital resources that could be modified for reuse. The team did investigate some online Irish IL tutorials for example - OLAS – a robust self-paced tutorial created at Waterford Institute of Technology (WIT) Libraries in the Republic of Ireland, Hegarty et al. (2004) and the LETS tutorials from Dublin City University (DCU). The review conducted helped to inform the educational design of the project.

Creating the ITT learning objects from scratch would equip the team with the expertise and skills necessary to develop sustainable RLOs. An added benefit of creating digital tools from the ground up would be to provide the team with an opportunity to brand the material, while at the same time helping to position the ITT Dublin educational developers at the forefront of RLO development across HE libraries in the Republic of Ireland.

The team explored the literature for examples of where RLOs have been effectively reused. Research in an Irish context uncovered little, Appleyard (2012) conducted a study into the sharing and reuse of IL resources in the UK HE sector and found “a notable lack of research into actual reuse beyond single institutions or projects” (2012, p.143). There are some examples of effective RLO reuse; Kendall et al. (2007) describe learning objects developed at Manchester Metropolitan University which have been repurposed for different disciplines. Similarly, Jackson and Mogg (2007) describe an IL Resource Bank of RLOs at Cardiff University which contains a group of “bite-sized” learning objects covering a range of IL concepts which have been adapted and repurposed and are applicable to an array of disciplines. In the US, Mardis and Ury (2008) emphasise the value of producing a library of flexibly-designed learning objects to ensure reuse.

2.9 Online repositories

The literature demonstrates the importance of online repositories with regard to the sharing and reusing of online instructional material (Mardis and Ury 2008, Kammerlocher et al. 2011). At the onset of the project, many RLOs were reviewed that are shared online via collaborative collections such as the NDLR, Jorum and WISC-Online Learning Object Repository. This research proved useful in terms of providing examples of best practice online educational content and also highlighted to the project team the value in depositing and sharing online learning materials.

Ward (2010) and Dundon et al. (2012) highlight the benefits of the NDLR online repository service in Ireland. One of the requirements in securing funding from the NDLR was to ensure that on completion, the ITT Dublin digital objects were deposited in this repository to be shared and reused by the wider Irish HE community. However, a review of the NDLR indicated that there were no existing digital learning resources that could be repurposed to meet the team's requirements and as a consequence the ITT RLOs were created from scratch. This analysis also identified barriers to sharing learning objects which included limited awareness of online repositories, copyright issues, licensing considerations and time constraints. This is supported by Dundon et al. (2012), who conducted a study with teaching staff from one of the NDLR Communities of Practice and found that more is needed in terms of encouraging Irish academics to contribute digital learning resources to online repositories.

White and Manton (2011), in a JISC-related study, explore the reuse of OERs in the UK HE sector, highlighting the potential value of these tools to support learners via repository initiatives such as Jorum. Appleyard (2012). They also highlight some of the other issues that repositories need to address in terms of enhancing the sharing of learning resources, including advancing the functionality of metadata and Web 2.0 in Jorum.

Further afield, Kammerlocher et al. (2011) and Reece (2007) discuss valuable collaborative repositories for sharing instructional materials in the USA such as the Peer-Reviewed Instructional Materials Online database (PRIMO) and the Multimedia Educational Resource for Learning and Online Teaching (MERLOT).

3. Design and Development

The project work commenced in April 2010 following the successful application to the NDLR and the securing of €3,000 in funding to create a range of RLOs. As previously discussed, these RLOs would need to be created from scratch. The original project team was largely made up of librarians, with input at various times from members of the academic community including lecturers, students, IT staff, and learning technologists from the Centre of Learning and Teaching (CELT).

ITT Dublin's IL framework provided the guiding structure from which the learning objects were designed. The framework is a three-level model (based on Australian and New Zealand (ANZIIL) Information Literacy Framework; Bundy, 2004) which facilitates learner progression from basic to more advanced IL competencies. An indicative set of learning outcomes for each level forms the basis of the instructional content and appropriate assessment techniques. The framework is flexible and the learning objectives have been used by the developers to guide the creation of each RLO. Blummer and Kritskaya (2009) highlight the value of using standards or competencies to direct the development of an online learning tool.

The learning objects take the form of short tutorials which encompass a range of interactive activities and quizzes. It was decided to keep the tutorials a relatively small size but large enough to ensure a worthwhile learning experience for the user. Kendall et al. (2007) debate the value of learning objects in terms of granularity (size of learning resource), indicating that the RLOs need to be small enough for reuse but large enough to enable a meaningful learning experience.

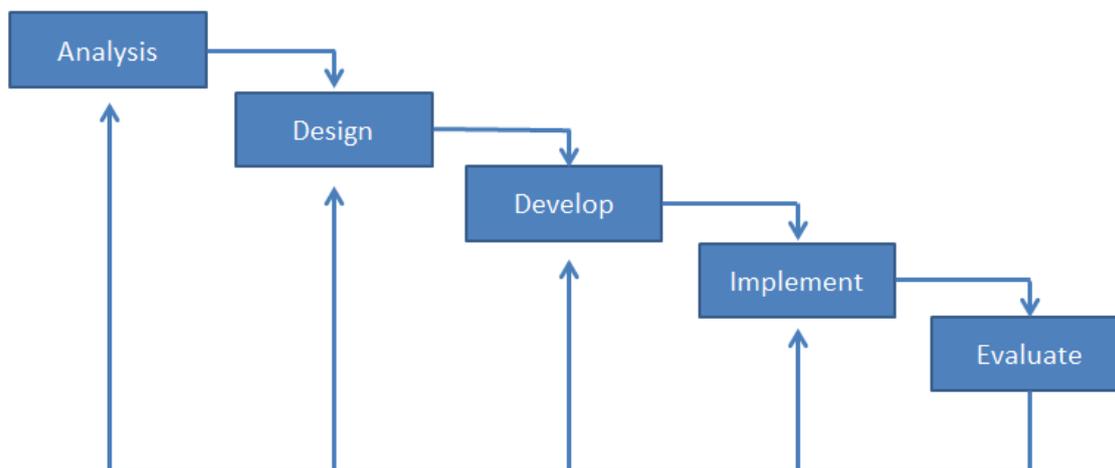
The tutorials are aimed at undergraduate and postgraduate students both on and off campus and to introduce users to some key IL skills. The first tutorials produced during the summer of 2010 were entitled *How To* and covered an introduction to the research process (creating a research strategy, identifying different sources of information, and finding items via the library catalogue). Additional tutorials created deal with the concept of plagiarism, how to avoid it and the plagiarism detection software Turnitin. A learning tool was also produced on referencing sources, including practical examples, using the Harvard referencing style.

Following an extensive review of software, Articulate Studio 9 was procured in spring 2010 to develop the learning objects (the product was also endorsed by the NDLR who provided a heavily discounted licence cost). Articulate facilitates rapid e-learning development and the creation of engaging courses, presentations and quizzes using multimedia content. The software is non-technical and has an easy-to-use functionality. Articulate uses MS PowerPoint to create multimedia content via Articulate's Presenter product and uses its other suite of tools – Articulate Engage, Quizmaker and Videomaker to complete the production of the online learning tool. Introductory training on the Articulate software was arranged locally for members of the project team and as the work commenced further ICT training included Flash, HTML, JavaScript, Dreamweaver, CSS and Photoshop Elements for image editing.

3.1 Instructional design of RLOs

The project team ensured that design of the tutorials followed best practice in relation to pedagogy, online instruction and accommodated the needs of a range of learning styles. An extensive period of preparation, storyboarding and development of learning activities and assessment tasks was undertaken for each tutorial before the online instructional design took place and the storyboards were converted to e-learning outputs. The stages of the design and development of the tutorials correspond with the standard model of instructional design developed by Royce (1970, cited in O'Neill et al. 2005 p.25).

Figure 1: Phases of Instructional Design



Source: Royce (1970)

Detailed storyboarding took place in Microsoft PowerPoint and this process facilitated seamless integration of content into Articulate's Presenter product. Storyboards included text, screenshots, and outlines of activities where appropriate.

Gagné's Nine Key Instructional Events (Gagné and Medsker 1996) strongly influenced the design of the tutorials. Each of these events is designed to support the internal processes of learning.

Table 2: Gagné's Nine Key Instructional Events as applied to the ITT Dublin RLOs

Level	Descriptor	Learning Activities in ITT Dublin RLOs
1	<i>Gaining learners' attention</i>	The tutorials were designed to address key concerns students have in the area of information literacy, such as referencing sources and avoiding plagiarism. This helps to motivate the students.
2	<i>Informing learners of objectives:</i>	Each tutorial begins with an introductory slide outlining a clear set of learning outcomes (see Figure 2, below). These learning outcomes state what learners are expected to be able to do and what knowledge they should possess on completion of the learning experience.
3	<i>Stimulating recall of prior learning:</i>	At the end of each tutorial a recap is provided with a summary of the learning objectives. This helps learners to consolidate new knowledge with old.
4	<i>Highlighting key features:</i>	The project team was keen to ensure that each of the tutorials were visually interesting for the user through appropriate use of color and graphics. The designers wanted to ensure that the student's attention was immediately captured by the learning object's visual identity. These stimuli are used to draw the learner's attention to important content.
5	<i>Structuring learning:</i>	The tutorials have been designed to require students to work through a sequenced learning structure, acquiring information literacy attributes as they build upon previous understanding and knowledge. The tutorials provide an easy to use navigational experience as users are provided with a side bar which outlines the learning outcomes and the key topics that are to be covered. This provides a logical sequence for the user to follow when engaging with the tutorial.
6	<i>Encouraging activity:</i>	The learning outcomes are triggered in the learning activities, quizzes and interactions requiring learners to respond and demonstrate learning.
7	<i>Providing feedback:</i>	Quizzes were added throughout the tutorials which are built on constructivist approaches. The quizzes provide immediate, informative, and specific feedback to the students. This helps learners to become aware of their learning and improve their satisfaction and motivation to continue learning.
8	<i>Assessing performance:</i>	Follow-up quizzes (summative and formative) are included to reinforce learning and demonstrate that the student has achieved the learning outcome. (see Figure 3, below).
9	<i>Enhancing retention and transfer.</i>	The tutorials are designed to be used in a blended learning environment where there is an opportunity for learners to practice their skills and to generalise their knowledge.

The overall design objective was to ensure that the student is at the centre of an iterative learning process and they will have an active and innovative educational experience.

Figure 2: Screenshot of the learning outcomes page for the Plagiarism RLO

Plagiarism

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Institiúid Teicneolaíochta Tamhlacht

Outline | Thumbnails

1. How to Avoid Plagiarism
2. Learning Outcomes
3. What is Plagiarism?
4. Intentional and Unintentional Plagiarism
5. Why Avoiding Plagiarism Matters
6. Forms of Plagiarism I
7. Forms of Plagiarism II
8. Plagiarism Quiz 1
9. Academic Penalties for Plagiarising
10. Plagiarism Detection Software
11. Using Turnitin
12. Turnitin Originality Report I
13. Turnitin Originality Report II
14. How to Avoid Plagiarism I
15. How to Avoid Plagiarism II
16. Plagiarism Quiz 2
17. Summary
18. Feedback

Learning Outcomes

When you have completed this tutorial you should be able to:

- Describe what plagiarism is.
- Explain how to avoid plagiarism.
- Outline the purpose of plagiarism detection software.

SLIDE 2 OF 18 | PAUSED | 00:16 / 00:16

Figure 3: Screenshot of the quiz page for the Plagiarism RLO

Plagiarism

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Institute of Technology Tallaght
Institiúid Teicneolaíochta Tamhlacht

Outline | Thumbnails

1. How to Avoid Plagiarism
2. Learning Outcomes
3. What is Plagiarism?
4. Intentional and Unintentional Plagiarism
5. Why Avoiding Plagiarism Matters
6. Forms of Plagiarism I
7. Forms of Plagiarism II
8. Plagiarism Quiz 1
9. Academic Penalties for Plagiarising
10. Plagiarism Detection Software
11. Using Turnitin
12. Turnitin Originality Report I
13. Turnitin Originality Report II
14. How to Avoid Plagiarism I
15. How to Avoid Plagiarism II
16. Plagiarism Quiz 2
17. Summary
18. Feedback

Plagiarism Quiz 1

Question 2 of 2 | Point Value: 10

Which of the following is plagiarism?
Select two answers and click Submit.

- Directly copying work from a friend's assignment
- Using ideas from a journal article but acknowledging the author
- Copying an image from the web without reference
- Using quotation marks and a reference when copying text from a book

Score so far: 10 points out of 10 | SUBMIT

SLIDE 8 OF 18 | PLAYING | 00:01

3.2 On-going RLO development and review

The first batch of RLOs were finalised during summer 2010 and took approximately 120 staff hours to complete over the course of three months. Extensive usability testing (with input from all stakeholders) and pilots of each of the tutorials were undertaken before they were launched, with feedback informing appropriate modifications. Each of the learning tools underwent final revisions before the RLOs went live in September 2010.

These digital resources are accessible via the ITT Dublin library website, the Institute's virtual learning environment (VLE), Moodle and the NDLR. Campbell (2003) emphasises the value of making RLOs available via multiple delivery platforms. The learning objects are robust, flexible tools and available to users 24/7 as self-paced online resources. In terms of e-learning standards they are SCORM (sharable content object reference model) 1.2 compliant and conform to best practice international accessibility guidelines - W3C AAA (Web Content Accessibility) Guidelines 1.0.

In the spring of 2011, a new batch of NDLR funding was made available with an additional €3,000 in funding being secured to continue the development of additional RLOs. The next tutorial covered the literature review concept and was designed by the existing library project team in summer 2011 (existing RLO development facilitated reuse of content for subsequent tools).

As of May 2013, a comprehensive suite of RLOs have now been created (see Figure 4, below). The production of these RLOs represents a new departure for the library; traditionally, the library's IL programme had focused on face-to-face approaches; however the development of these RLOs signifies a move into the blended and online learning environment.

Figure 4: Details of the RLOs

Subject Area	RLO	Delivery Context
Business; Humanities	<i>How to Research your Assignment</i>	Lecture, IL workshop, Moodle
All disciplines	<i>How to Avoid Plagiarism</i>	Lecture, IL workshop, Moodle
Business; Humanities	<i>How to Reference your Sources</i>	Lecture, IL workshop, Moodle
Business; Humanities; Science	<i>How to Write a Literature Review</i>	Seminar, small group tutorials, Moodle

4. Implementation

The online tutorials can be used in a variety of learning contexts and can be accessed by students 24/7 from the library website or via a course page on Moodle. The VLE provides an ideal environment to facilitate the delivery of the tutorials. The literature supports this – an online library tool is often successful having been embedded into this learning platform (Lo and McCraw Dale 2009; Hegarty *et al.* 2004; Patalong 2003). The files for the learning objects can be easily uploaded into the VLE. The tutorials can then be embedded into module pages on Moodle where they can be used by students to support independent learning or be used by lecturers to provide in-class teaching without the need for librarian support. Institute teaching staff have highlighted the value of adding the learning tools to their module pages in Moodle. Embedding the tutorials in Moodle facilitates summative and formative assessment by tracking student progress through the tutorials and capturing students' grades in the in-built quizzes; data which can then be collated by a lecturer using a grader report.

4.1 Modules where the RLOs have been applied

The production of RLOs at ITT Dublin has been a key enabler in terms of integrating IL into academic courses. This point is borne out by Jackson and Mogg (2007), who indicate that the RLOs developed at Cardiff University provide a means of embedding IL into the curriculum. The project team was keen to ensure that the RLOs were applicable to a range of disciplines and on completion could be easily integrated into teaching modules. As of May 2013, the learning tools have been embedded (via Moodle) into over 35 undergraduate academic modules across all disciplines and levels of study.

Figure 5: Details of RLOs integrated into modules on VLE

Subject	Number of Modules
Engineering	7
Business & Humanities	13
Science	8
Computing	4
Other	3
Total	35

The provision of the RLOs has instigated major opportunities for librarian/academic collaboration, in particular the delivery of a new *Learning to Learn* module, which was launched by ITT Dublin in September 2012. This 5-credit module is mandatory for all first-year students at ITT Dublin and covers core study and academic skills including IL, which is one of the key learning outcomes. The library's RLO project lead was involved in the design of this module and all the RLOs have been added to the *Learning to Learn* module description as required learning resources. Librarians have been working in close partnership with academics coordinating this module and initial feedback has been very encouraging with the RLOs supporting the delivery of the module via Moodle.

The *Learning to Learn* module in the School of Engineering makes extensive use of the RLOs. First-year students on this module were required to reflect on how the study and literacy skills being taught influenced their performance, with this process of continual personal improvement being supported by student completion of the RLOs on Moodle. Lecturers and librarians have worked collaboratively on this module with staff underlining the benefits of the RLOs to providing students with an enriching learning experience and helping them to attain educational objectives at third level.

In the academic year 2012-2013, marketing lecturers for a first-year business communications course incorporated the RLOs on research, writing a literature review, referencing and plagiarism into the module description; with student completion of the tutorials on Moodle being a key element of continuous assessment (the RLO's quizzes provided the assessment mechanism). The delivery of this blended instruction took place as part of a first semester library workshop - the library subject liaison for business provided a brief overview on plagiarism and referencing in the library lab, with students then going online to complete the relevant RLO on Moodle. The combination of face-to-face dialogue and e-learning activities enthused the students, as well as making it an enjoyable experience for the instructor, with a follow up session indicating improved IL skills.

Other departments have also made significant use of the RLOs via the VLE; the department of applied science has incorporated the tools into numerous modules on Moodle - a second year pharmaceutical science course adapted the research RLO to meet the module's specific requirements; similarly a third year sports science programme has made significant use of the RLOs on plagiarism and referencing, which were completed in class by students as part of collaborative group work. Lecturers on this course commented on how engaged the students

became when undertaking the RLO's activities, demonstrating a sense of achievement on completion.

Some of the interactive activities in the RLOs have been used for other instructional purposes; for example, the self-tests and quizzes in the literature review RLO have been adapted to support online teaching materials for second-year social care students. In addition, the library's IL team has extracted many of the tests from the tutorials to be reused in print format to support IL workshops where PCs are unavailable.

5. Sharing with the wider community

The development of the RLOs has fostered active engagement with the regional community, with the digital resources being modified for reuse by school libraries and public libraries in the South Dublin region via a local teachmeet (an informal meeting of librarians (often cross-sectoral) who come together to share experiences, common interests and best practices) initiative.

On a national level, a prerequisite for securing the funding from the NDLR was to share and disseminate these digital learning resources to the wider higher education community. The ITT Dublin RLOs are currently hosted under a Creative Commons (CC) License on the NDLR website where the teaching and learning resources can be shared, reused and repurposed by the academic community locally and globally. Reece (2007, p.491) lauds the value of open publication licences such as Creative Commons in terms of enabling "instructional materials to be iteratively improved and adapted by peers".

The ITT open educational resources have been harvested by other Irish third-level institutions with the RLOs being adapted or reused or links to the learning objects being added to an institution's library or departmental website. For example, Waterford Institute of Technology (WIT) library downloaded the SCORM files for the referencing and plagiarism tutorials via the NDLR; the tools were subsequently modified locally and used to support IL skills training for first-year undergraduate nursing students. Similarly, the library at St. Patrick's College, a third-level college of education in Thurles, Tipperary, is using the RLO on referencing as part of a mandatory *Introduction to Third Level and ICT* module for all first-year students. The libraries at University College Dublin (UCD) have also recently repurposed the plagiarism, referencing and literature review tutorials in support of their IL programmes. Other HE providers such as the Teaching and Learning Centre at the Institute of Technology Carlow and the Institute of Technology Blanchardstown (ITB) have provided external links to the ITT Dublin RLOs for their students to access via their respective websites.

The tools have enhanced inter-institutional collaboration in the context of sharing knowledge, skills and resources. In designing and developing these RLOs, the project team also tapped into existing expertise within a number of third-level institutions in Ireland; the team engaged with colleagues at Dundalk Institute of Technology (DKIT) library who had previous experience in designing online learning tools using Articulate software.

Similarly, the ITT Dublin developers have shared knowledge and practical skills, offering training to members of the wider academic community in terms of delivering quality e-learning content. Face-to-face training was provided to library staff at the National University of Ireland Maynooth (NUIM) library on the advanced features of Articulate, enabling the developers there to maximise the functionalities of the software.

Internationally, anyone, in any location, can view the NDLR's OERs and the ITT Dublin RLOs have generated global interest with the learning materials being viewed and downloaded from users as far afield as US, Australia, Brazil, Russia and China.

6. Evaluation

The project team was aware that for the RLOs to be meaningful, there was a need to employ a range of evaluative techniques to monitor progress, gather feedback and measure their effectiveness. This is supported by Hutchings et al. (2007) and Thornes (2012, p.85) who points out that “evaluation and feedback are essential to accurately judge whether an online resource is meeting the needs of students”. Feedback is garnered from all users of each of the RLOs. Statistical data and usage figures are attained via the online survey tool (SurveyGizmo), the ITT Dublin library website (using Google Analytics), Moodle and the NDLR.

SurveyGizmo is the main instrument used to monitor progress and capture usage data for the RLOs. This software is highly regarded internationally as a tool to capture robust statistical information and a review of the research indicated its suitability for the ITT RLOs. Sylvain et al. (2011) point out that SurveyGizmo software was used to capture data for learning objects developed at the University of Massachusetts. A link to SurveyGizmo is provided at the end of each of the ITT tutorials; the survey form contains about 8 questions using a mix of quantitative and qualitative questions; with open-ended questions helping to capture a wide range of views and opinions. The survey takes the user a couple of minutes to complete but provides invaluable data. Google Analytics has been employed since September 2011 to capture web-related usage statistics and provides another layer of informative data. Befus and Byrne (2011) refer to the value of Google Analytics for capturing RLO statistics at Wayne State University Library. Moodle allows the project team to capture usage statistics for the RLOs hosted on the VLE via a statistical tracking mechanism which provides user stats in addition to indicating how the user fared via the quizzes. These learning objects are also hosted on the NDLR website and this provides a further mechanism to capture usage data in terms of the RLOs being used by members of the wider academic community in Ireland and internationally - see Figure 6 below. If there are limitations to the NDLR usage statistics, it is that data is not captured with regard to the type of user or institution that is viewing or downloading the RLOs.

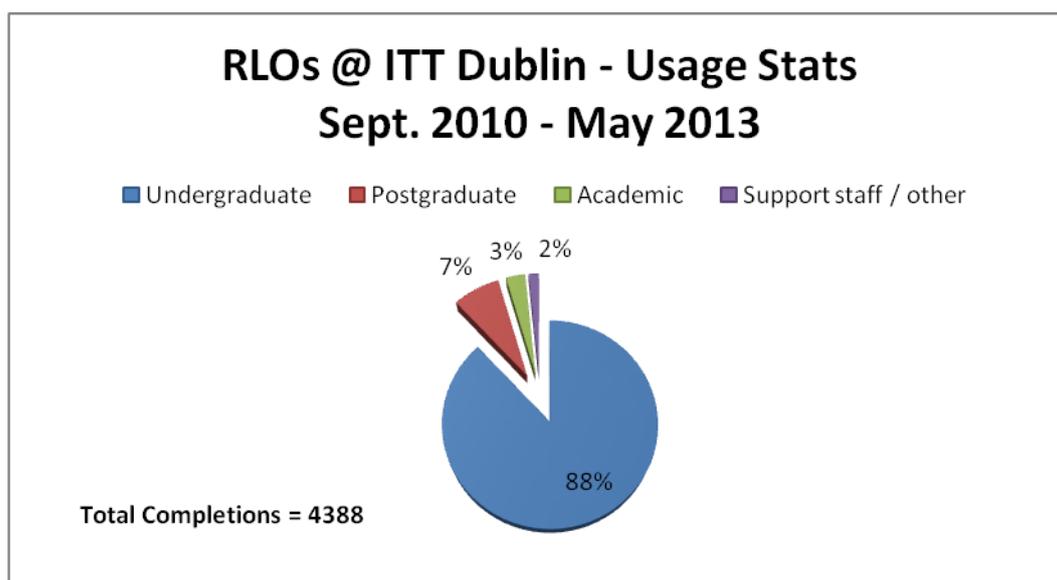
**Figure 6: Number of views / downloads of ITT Dublin RLOs via the NDLR
Sept. 2010 – May 2013**

Name of tutorial	Views	Downloads
<i>How to Research your Assignment</i>	107	66
<i>How to Avoid Plagiarism</i>	115	51
<i>How to Reference your Sources</i>	129	57
<i>How to Write a Literature Review</i>	213	118

Other evaluative measures include noting anecdotal observations, with feedback also being captured informally on a regular basis from all stakeholders including library staff, students and academic staff. Input is provided via IL training sessions and various academic meetings such as the library committee, institute academic council and departmental programme boards. Focus groups were also arranged with students across all disciplines and years to garner more in-depth qualitative data. Some of the feedback captured during these engagements was very useful in terms of what does and doesn't work well with the RLOs and led to modifications in the tutorial design.

Collating all the usage statistics via the various evaluative mechanisms indicates that, since September 2010 when the first RLO was launched until May 2013, the tutorials have achieved nearly 4400 completions with over 3,036 students providing online feedback via SurveyGizmo (shown in Figure 7, below). Undergraduates were the bulk of respondents (88%) with a high level of usage amongst business departments and the department of applied science.

Figure 7: Usage statistics for RLOs



A significant level of qualitative comments have been captured from all users via SurveyGizmo (see Figure 8). Student feedback yielded comments on ease of use, accessibility and technical issues. The response from the student cohort also indicated a new level of knowledge with regard to their awareness and use of information resources. A number of respondents commented on the accessibility of the RLOs at point-of-need and highlighted the value of applying skills online in an engaging environment. Students felt that the RLOs availability made it easier for them to integrate into third-level education.

Feedback elicited from academic staff largely related to teaching relevance, the importance of the RLOs to academic modules, accessibility, VLE integration and minor technical difficulties. There has been a greater usage of the RLOs by some academic departments more than others but this in many cases reflects greater student numbers and the traditional departmental usage of information resources.

Figure 8: Selection of comments extracted from SurveyGizmo

Comment	Discipline
“Great tutorial - very good explanation of plagiarism and how to avoid it. Thought the quiz was very useful - meant I could check that I understood the material in the tutorial – thanks”	Second year Science student
“As a new student this online resource has made my introduction to college a lot easier, and helped me with my studies. I feel that I am more likely to succeed now at all levels of my course”	First year marketing student
“This tutorial is an extremely useful resource for my business students. I will add to my teaching on Moodle. Thanks”	Business lecturer
“I felt the library tutorial was a great way to find out how to organize and apply the skills necessary in order to complete a literature review. Easy to use and very helpful for active learning”	Third year Humanities student

Feedback captured from users has been used to improve the learning objects. For example, the first batch of tutorials created in summer 2010 had a series of quizzes which did not give participants feedback if they selected an incorrect response. Similarly, data collated highlighted the need for the user to be able to leave the tutorial at any stage and also to complete the RLO a number of times. Subsequent tutorial development addressed these issues. The RLOs were also designed without any narration – many users have highlighted the need for audio to be added to the learning objects and there are plans to include it in future revisions.

7. Challenges

Referring to the challenges in developing online IL material, Wales and Robertson (2008) point out that a discussion of how problems are overcome often provides the greatest insight for practitioners.

As the team worked to develop the resources, a number of issues were encountered and lessons learned. These issues included time commitments; the project team were in many respects over-ambitious in the number of RLOs they planned to develop in the given timeframes; some of the resources needed to be developed during the academic year in conjunction with teaching staff and the input of students; this on top of existing responsibilities and time pressures led to difficulties in completing the tools within the required time and ensured that the learning objects did not include any narration.

A lack of staffing resources challenged members of the team to adapt quickly, learn a whole new skill set and assume a variety of roles which included instructional designers, content specialists, web authors and project managers. Many of the resourcing issues and time constraints were however surmounted by collaborating with academic colleagues in terms of sharing knowledge, expertise and skills. Mestre et al. (2011) indicate that limited pedagogical training is provided for librarians involved in the creation of online resources. Most of the librarian team lacked training in the basics of pedagogy and instructional design. This led to difficulties in terms of writing learning outcomes for the RLOs, developing content and designing sophisticated assessment methods. Similarly, the project team had no previous knowledge of the Articulate software or what was required in terms of designing an interactive learning object that is searchable, accessible and reusable. To meet this challenge, the project lead prioritised ongoing training in online pedagogy and instructional design to equip the team with the skills necessary to design quality learning objects. In addition, in-depth training was organised on the use of the Articulate software which proved invaluable in terms of dealing with some of the specialised IT problems which arose.

Technical issues were encountered at various junctures of RLO development; during the design stage, difficulties arose with regard to version control with many different versions of the Articulate files being created and shared across multiple network drives. The initial learning objects were also produced using a combination of Captivate and Articulate software which led to functionality issues during multiple student use. An additional technical challenge was accessibility compliance and ensuring that the completed digital resources adhered to best practice web accessibility guidelines. Articulate Studio publishes files to Flash format which are not accessible from iOS devices (this issue will be overcome in the latest version of Articulate – Storyline which has iPad/HTML5 publish features which are fully accessible from all mobile devices).

Another challenging aspect was to ensure that the learning tools met the needs of a diverse range of students; with an increasing number of students from different ethnic backgrounds and a growing body of Erasmus and international students, it was essential that the developers were aware of this and the wording and content of the learning objects reflected the needs of users who do not have English as their first language. There is also the on-going challenge of promoting the RLOs to the academic community – effective collaborative work and marketing the digital objects as *How To Tutorials* has so far proved successful in this regard.

8. Future Directions

The RLO development in ITT Dublin has created a high-quality learning environment and provided greater opportunities for students to develop the core skills which are essential to their ongoing academic progression and active participation in twenty-first century society. The RLOs have presented students with a learning platform to critically analyse information, think independently and creatively, problem solve and engage in reflective practice. They have facilitated self-directed research and provided students with an active and engaging approach to learning, thereby deepening their overall educational experience. The RLOs have also helped to facilitate a smooth pathway into HE for those students who are new to third-level learning.

The demand from the academic community for these learning objects has grown, with significant need resulting in the introduction of the *Learning to Learn* module. The primary focus over the next few years will be the development of a deeper suite of resources that supports this module. A new package of e-learning objects called *Reinvent* are currently being created by library staff and lecturers from the department of mechanical engineering and will support the following core skills: study planning, note taking, time management, report writing, creative thinking; presentations; reflection and language. It is essential for new partnerships to be cultivated not only with teaching staff but to expand the collaborative online approach to IL instruction to include learning technologists, IT specialists and students. There is also a need for the tutorials to be embedded into more academic modules – in addition to the *Learning to Learn* Module, ITT Dublin is also planning fully-online courses and the learning objects can be adapted to support emerging teaching programmes. The RLOs will be the catalyst for librarians and academic staff to continue to collaborate to embed IL skills into the curriculum.

The support of a constructivist approach to learning will have to be further researched; while the RLOs were designed with constructivist principles in mind, the approach taken by students depends largely on how the resources are introduced and supported during the instructional setting. The feedback mechanisms and statistical data collated on the RLOs are of significant value and will guide future provision and help secure further funding. A more in-depth scientific analysis will need to be conducted, however, to assess the overall impact of the RLOs in terms of academic marks and standards.

A number of further developments to the resources could be made including: possible translation of the RLOs into different languages to accommodate the growing intake of international students; a specific RLO on critical thinking; and more targeted tutorials for researchers to include possible topics such as bibliographies and reference management. Further staff training is also required and the development of example scenarios to help staff understand how to get the best out of the RLOs. The inclusion of narration and supporting videos for the resources is seen as an essential next step; it is well known that students respond positively to a more visual resource but the narration will help users understand the theory being presented and guide their actions. There has been a significant increase in the number of students accessing the ITT Dublin library website via mobile devices and to meet the demands of these users, there are plans to make the RLOs available via mobile platforms.

The RLOs have enhanced academic collaboration and cooperation at local and national level and have created a landscape for the sharing of knowledge, skills and quality teaching and learning resources. Through the development of these RLOs, the library will continue to interact and collaborate nationally and internationally. Via the NDLR and other channels and facilitated by Creative Commons (CC) licence, the RLOs have already been shared and made available for reuse and repurposing in a number of Irish HE institutions. This is being extended with the SCORM files for the RLOs currently being made available via Jorum in the UK and the objects were recently added to PRIMO in the US where they awarded 'Site of the Month' for September 2013. The project team will also investigate the reuse of existing RLOs on the NDLR or other national repositories. Since 2010, the sharing of quality resources via the NDLR has progressed with RLOs such as MyRI bibliometrics toolkit.

The interest in the ITT Dublin RLOs has extended overseas following a successful poster presentation by the authors at the LILAC Conference in Glasgow in April 2012. Following on from the positive feedback at this conference, there has been correspondence between the authors in relation to the RLO development with librarians and academics from HE institutions in the UK, France, Scandinavia, the US and Canada. The principal librarian developer of the RLOs has also been invited to participate in DELILA, a new initiative to highlight IL OERs, which is a collaborative partnership between the CILIP IL group and UNESCO.

Resources

The RLOs created at ITT Dublin are available to use so please contact the authors for further details: <http://millennium.it-tallaght.ie/screens/tut.html> / <http://www.ndlr.ie/>

JISC OER Infokit: <https://openeducationalresources.pbworks.com/w/page/24836480/home>

DCU Library eTutorial for students: <http://www.library.dcu.ie/lets/index.htm>

Jorum: www.jorum.ac.uk

WISC-Online Learning Object Repository: www.wisc-online.com

Peer-Reviewed Instructional Materials Online database (PRIMO):
<http://www.ala.org/cfapps/primopublicsearch.cfm>

Multimedia Educational Resource for Learning and Online Teaching (MERLOT):
<http://www.merlot.org/merlot/index.htm>

MyRI bibliometrics toolkit: <http://www.ndlr.ie/myri/>

DELILA project blog: <http://delilaopen.wordpress.com/>

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