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Interprofessional E-Learning and Collaborative Work: Practices and Technologies

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Chapter 20

Reusable Learning Objects in Health Care Education

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ABSTRACT

This chapter will review the definition, development and characteristics of reusable learning objects (RLOs) and outline examples of how these resources are meeting the challenges of interprofessional learning. It will discuss the ways in which pedagogy is developed and expressed within RLOs and how this may impact on interprofessionalism.

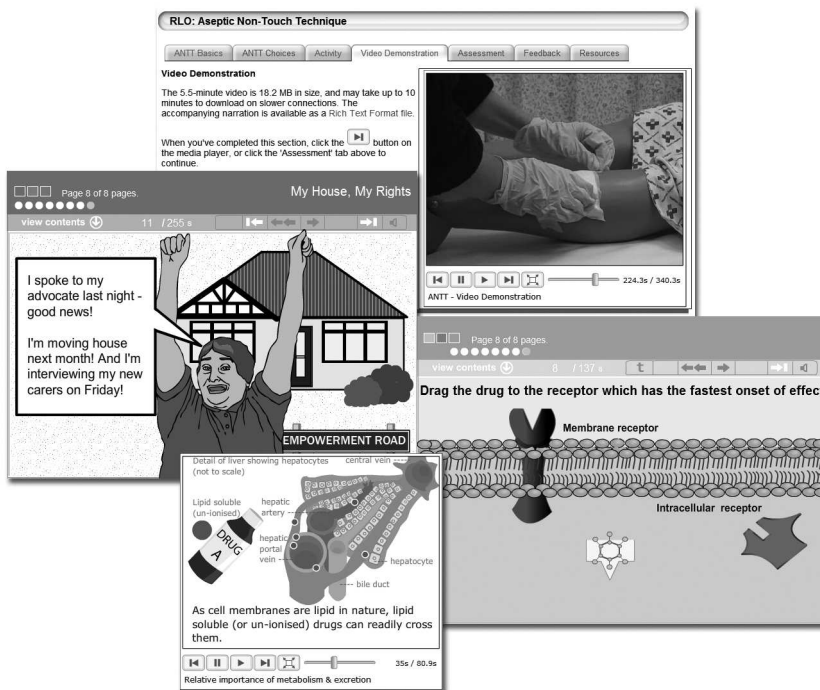
INTRODUCTION

Reusable learning objects (RLOs) are small, granular e-learning resources. They generally utilize multimedia elements to engage the learner in a visual and interactive learning experience. They are mostly web-based and increasingly are being offered as open-education resources, which can easily be accessed and used. Screen-shots from some health-related RLOs which have been used with interprofessional groups are shown in Figure 1, and “live” examples can be found at the following websites/repositories SONET (University of Nottingham, 2009), CIPEL (2009) and UCEL (2009).

As the name suggests, sharing and reusability are important drivers for the RLO model of e-learning. This philosophy has obvious resonance with interprofessional learning. At its best, it influences every aspect of the design, creation and delivery of the resources. This includes the types of repositories used, compliance with technical standards to allow interoperability between IT systems and the licensing/copyright models adopted. A robust learning object economy based on sharing of resources between diverse stakeholder groups has long been the vision of many in this field (Gunn, Woodgate & O’Grady, 2005; Weller, 2004). Such an economy offsets the production-costs of high quality, media-rich learning resources, by the number of times they can be reused; by different cohorts on the same

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Figure 1. Screenshots taken from examples of RLOs used for interprofessional learning



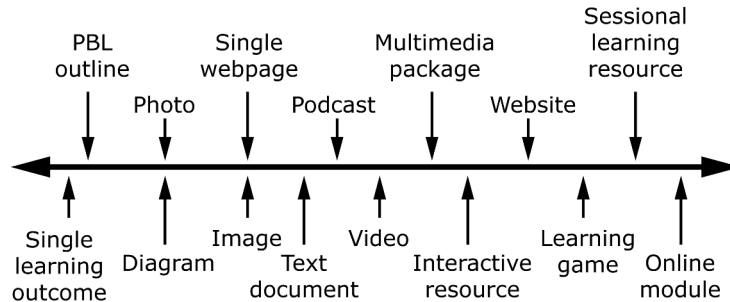
course (vertical reuse), on different courses within the same institution (horizontal reuse) and between institutions, making the final cost per student a miniscule amount.

Although this model has resonance in many areas of higher and further education, it has particular potential in the area of interprofessional health and social care education given the large numbers of students involved. This is multiplied by the wide variety of health and social care courses offered by any one institution, the number of institutions offering such courses and the emphasis on continuing or life-long learning in this area. Taken together these factors mean that certain subject areas are revisited many times. For example, think for a moment how often hand-washing is taught within a given institution; between cohorts, on different courses and for different health and social care disciplines. When this is multiplied by the

number of institutions teaching these courses in one form or another, the true potential for sharing becomes apparent.

Indeed, RLOs have been taken up extensively in health and social care education and have proved highly effective in meeting the educational challenges that these curricula face. For example, a series of chemistry RLOs were developed for an interprofessional nursing and midwifery programme to address the difficulties that these students experienced in this area. These proved to be highly popular and effective for these groups, both reducing anxiety and improving knowledge (Windle et al., 2007b). Moreover, these RLOs have also been widely reused by other health care professional students throughout the world. This suggests that that the RLO approach is effective at addressing similar areas of difficulty across the health care professions.

Figure 2. The reusable learning object continuum, demonstrating examples of the range of resources that have been defined under this umbrella term



Despite examples like the one given above, and those that appear in a chapter by Wharrad and Windle in this volume, examples of widespread cross-institutional reuse are rare. Take the example of hand washing again. A quick internet search reveals the multitude of virtually identical learning objects produced by different organisations in this area. There does not appear to be an unwillingness to share resources on the part of those developing them (Currier & Campbell, 2002), but rather an unwillingness, or inability to reuse resources produced by others. This so-called “not invented here” syndrome is complex, but is partly related to a perceived lack of ownership of the resources by the potential reuser (Bond, Ingram & Ryan, 2008). Therefore, there is a need to design RLOs to overcome this barrier in order to optimize their potential for reuse.

Although the drivers and barriers to sharing and reuse do not necessarily equate directly with those that influence interprofessional effectiveness, there are obvious similarities. It could be argued that a resource that is optimized for reuse and which empowers the reuser will have many qualities that make it suitable for an interprofessional audience. This chapter will explore aspects of the RLO philosophy that make it successful in modern health and social care education and the extent to which these support or hinder sharing in an interprofessional environment. In particular it will:

- Explore the definitions of RLOs;
- Discuss the community of practice approach that is so often at the heart of RLO development;
- Build a model of the pedagogical attributes that are encompassed by RLOs to investigate their relevance to interprofessional use and sharing.

BACKGROUND

Exploring the Definition of Reusable Learning Objects

The term reusable learning object is used widely and can mean very different things depending on the context of its use, or the user. Perhaps the most widely accepted definition of an RLO is that proposed by Wiley as “any digital resource that can be reused to support learning” (Wiley, 2000). Although this is solid and objective, it is a very broad definition and can be applied to a wide array of resources that have traditionally be given the label “RLO.” Some examples of materials that have been included within the RLO umbrella are shown in Figure 2. The term can be seen to encompass everything from a couple of lines of text, to an entire multimedia module.

However, this broad interpretation of what constitutes an RLO is problematic for a number

of reasons. Firstly, learning object repositories are often composed of a bewildering assortment of resources. This can hinder sharing and reuse as any potential user must navigate through an eclectic jumble of resources with variable pedagogical qualities and value. Not only does this make searching for the appropriate resource time consuming and difficult, but it may also undermine confidence in the quality of the resources being offered. Secondly, it is the materials at either end of the continuum (Figure 2) that are most open to criticism. At one extreme, materials are criticized for being so small that they have little or no educational value as learning resources, being meaningless out of the context for which they were created. At the other extreme, materials are too large to be seriously reused in any other context (Friesen, 2003; Polsani, 2003). Therefore, it may be argued that a more focused, less inclusive understanding of what constitutes an RLO is needed to provide confidence in their use and reuse. The very name reusable learning object itself provides a good starting point for this more focused understanding.

Reusable

Reusable implies that the content is appropriate for learners, outwith the immediate group that it was intended for. Thus the content being covered must have meaning and importance for different groups of learners. It also means that any contextual references included must not preclude its use by other groups. The reduction in contextual reference points can provide a tension between use and reuse (Freisen, 2003; Nurmi & Jaakkola, 2005). Generally, materials designed for use with a particular group benefit from rich contextualization in the form of familiar examples and so on. However, reuse is best served by context-neutral materials. This tension has obvious resonance for the potential use of resources in an interprofes-

sional sphere. Take an RLO on an aspect of pharmacokinetics for example. It is clear that in order to explain this concept clearly, learning facilitators would prefer to use examples of drugs that are familiar to the learning group they are working with, but that these examples may be unfamiliar to practitioners in a different practice-discipline, who may wish to reuse the resource. However, with careful design it is possible to balance this issue (see Wharrad and Windle's chapter in this volume) if consideration is given to the range of examples of drugs included and to their context of use. In some cases generic or hypothetical examples are used to illustrate the learning goal being addressed.

Reusability also requires that a resource is platform-independent. Resources requiring specialized software for delivery should be excluded, as should resources that are developed for, or locked away within, proprietary learning management systems or web environments. Formats such as HTML are most appropriate. Formats that have gained a high level of ubiquity in distribution such as Adobe Flash (player) are also appropriate. However, caution should be applied when downloadable drivers or driver-updates are required. Even if these are freely available, the presence of prohibitive security safeguards on networked computing environments is common in most health-care environments and may hinder reuse.

Resources should also be excluded if they are released with restrictive or prohibitive licensing agreements. Many suitable licensing models are available to support reuse, such as the Creative Commons Licensing model (Creative Commons, 2009). This allows the owner of the material to distribute them freely for use and repurposing whilst retaining the copyright. The distributor of the RLO must have rights to use and distribute the media assets included within any resource, paying particular attention to materials where the copyright may be owned by a third party.

Case-studies, simulations and scenarios such as the RLO “Gateways to Health” (UCEL, 2009) are popular approaches to the development of RLOs for an interprofessional audience. Authenticity is an important aspect of interprofessional learning, but in order to allow resources to be reusable careful attention must be paid to any potential issues of confidentiality for an individual or institution. Likewise, ethical and cultural issues must be respected in the design of such resources,

Finally, for a resource to be considered reusable, it must be available for distribution in a form that is easy to locate and embed. Materials should be labeled with key terms that are searchable and meaningful to the different interprofessional groups who may access it. Materials should also be offered in a format that is standards-compliant, such as an IMS content (IMS, 2005) or SCORM package (SCORM, 2004), so that it can be easily incorporated into learning systems.

Learning

For the term “*learning*” to be applied to a resource requires that it is more than merely a knowledge or content object, but rather that it has an inherent pedagogy (Boyle and Cook, 2003). The lack of attention to pedagogy in some resources, or the fact that they are instructivist rather than constructivist in nature, has invited further criticism of RLOs in general (Nurmi & Jaakkola, 2005), as has the fact that their design is sometimes driven more by technical considerations than real learners’ needs (Friesen, 2003). However, in recent years there have been attempts to address these concerns with an increased emphasis on pedagogy. Therefore, it can be argued that for any resource to be considered an RLO it should have an inherent pedagogy which engages the learner in an interactive learning experience. It might require them to develop, consider, manipulate, reflect upon, measure or analyse knowledge. Examples

of this interactive approach can be seen in many of the RLOs in the collections outlined above. Another chapter in this volume by Wharrad and Windle outlines how this approach has been used in order to develop a family of objects that inform and challenge health care staff from a range of professions about improvement culture within their organizations. It should be noted that adherence to these guidelines may considerably limit the amount of resources falling within the RLO category, but will allow the user or learning facilitator to approach materials bearing the RLO title with far more confidence.

Confidence in the learning quality of a resource can also be fostered by more robust attention to quality control to ensure the validity of the content and the pedagogical approaches adopted. These quality control processes should be apparent and transparent. It is perhaps going too far to suggest that in order to be called an RLO a resource should have undergone such a procedure, but it does represent best practice. The current metadata schemes that have been designed for learning objects to not include provision for recording such processes, but this could easily be addressed. The issue of quality assurance is of particular relevance to resources used in relation to health and social care where the accuracy of the content within a resource may be of paramount importance. A quality assurance process also allows the materials to be reviewed by members of different professional groups, ensuring that that everyone can have confidence in its ability to support h.

Object

The term “*object*” when applied to an RLO encompasses two important aspects of its construction. Firstly, it implies a level of portability and unity. For a resource to be called an RLO, it should be complete within itself and self-contained, adhering to the decoupling and cohesion model proposed

by Boyle (2002). It should require no external dependencies or links to other materials in order to function as a learning resource. Secondly, the term implies something that is small in size, or granular in nature. Evaluation with health care students has shown that small packages of e-learning are often their preferred format (Wharrad, Kent, Allcock & Wood, 2001).

However, granularity is very hard to define. What is small, what is granular? Lack of clarity or direction in relation to this parameter, perhaps more than any other, has led to the diversity of resources encompassed within Wiley's definition (Wiley, 2000). So how should we begin to define a level of granularity that constitutes an RLO? It may be possible to determine this pedagogically. In general a learning object should only cover a single concept or learning goal.

Alternatively, it may be possible to define a suitable level of granularity from a behavioral perspective, by suggesting that a single RLO should represent about 5-20 minutes worth of learning activity for the learner. However, this too is problematic for obvious reasons, as it supports an instructivist approach to learning as the time is defined by the RLO author rather than the learner. A pragmatic approach to this question based on the analogy of RLOs as "learning atoms" (Young & Morrison, 2002) may be helpful. In general an RLO should represent the highest level of granularity, or smallest divisible unit of learning, that it is possible to achieve whilst retaining the purpose and holism of a single learning task.

It is recognized that a reductionist approach to e-learning has again been a major source of criticism of RLOs, but it should be noted that despite their individuality, RLOs often work synergistically with one another, especially when combined and contextualized as part of a well planned learning facilitation. Modern tools are being developed that support this combining of resources, whilst allowing each individual resource to retain its independence.

QUALITIES OF RLOS IN RELATION TO THEIR USE IN HEALTH CARE EDUCATION

Development Processes

To appreciate the full potential of RLOs for inter-professional learning, it is important to take a step back from the resources themselves and consider their developmental framework. This discussion will draw upon experiences from the Centre for Excellence in Teaching and Learning for Reusable Learning Objects (RLO-CETL, 2009), Centre, but has resonance with many contemporary RLO-based development initiatives. The RLO-CETL was set up and funded by the Higher Education Funding Council for England in 2005 in an attempt to seed improvements in learning and teaching within higher education. The RLO-CETL is based at three institutions, London Metropolitan University, the University of Cambridge and the University of Nottingham. Its aim is to develop, research, implement and disseminate best practice in RLO development and design.

The detail of the development process that has been developed by the RLO-CETL has been published previously (Boyle et al., 2006). It begins with scoping workshops in which teams are brought together. These workshops have the functions of team building, exploring the nature and potential of RLOs and beginning to scope the outlines of the resource. At this point, the process remains technology-neutral and initial planning is done using large wipable storyboards. This is important as it prevents disenfranchisement of those who do not feel comfortable with technology and also prevents the constraint of creativity by the confines of the technology. Then the process of iterative development begins. Initially, the team work to develop a detailed storyboard, or specification. Before the specification enters the media development phase it undergoes a series of quality control audits or reviews. It is reviewed by an independent content specialist, representatives

from the target learning group and also undergoes pedagogical and technical review if required. A series of tools have been constructed for this purpose. Only on successful completion of these reviews and necessary revisions do the materials enter the media development phase. Developers are free to use whatever software and media are appropriate and best meet the pedagogical needs outlined, so long as they remain within the guidelines outlined above.

Following completion of this phase, the review stage outlined above is repeated with a set of tools that focus on the media representations of the pedagogy. Finally, following further revision, the RLO is released. Generally it will be released for use with the target group of learners first. Extensive feedback and evaluation is collected from this group in the initial phase of release. Details of the evaluation toolkit that has been created for this purpose, together with examples of evaluations of projects where RLOs have been used for interprofessional learning within Higher Education, Further Education and work-based learning are discussed in a chapter by Wharrad and Windle in this volume. Following evaluation and any necessary revision, the RLO will be released for open access as a content package labeled with metadata in the form of keywords, description and information regarding provenance, educational and technical format. Evaluation of the resource and its reuse continues through the inclusion of an online feedback form.

Traditionally many e-learning developments have been seen as “top-down” in nature with too great an emphasis on technical standards rather than pedagogy. This can lead to a mismatch between the developed resources and real learner requirements. Conversely, RLO development initiatives are often seen as “bottom-up” approaches that seek to empower key stakeholders to participate in and manage the e-learning development process (Cook, Holley, Smith, Haynes & Bradley, 2006). The RLO-CETL, like many other projects, has a development framework based on Wenger’s

community of practice model of organization (Wenger, 1998). The communities of practice fostered by the RLO-CETL consist primarily of lecturers and students from various disciplines who together develop small families of RLOs to address learning needs that they have identified. The communities are supported by instructional designers and multi-media developers. Whilst the model adopted does not represent a perfect adherence to the community of practice model, it does illustrate three elements that Wenger suggests should be found in a functional community of practice.

Firstly, members of a community of practice should have a sense of connectedness, effective communication and belonging. Extensive research using network analysis has been conducted within the RLO-CETL’s communities of practice. This has demonstrated a high degree of connection between the members of the RLO-CETL’s communities and also shown them to be dynamic and adaptive, mirroring the “life cycle” model of community outlined by Wenger (Morales & Carmichael, 2007).

Secondly, members should have an active and meaningful role. The actions they undertake should have purpose and value and be suited to the skills and needs of the individual providing them. It is certainly the case that tutors and learners are best placed to understand real learning needs and how these can be addressed within a given field. Other members of the team help in the formation of successful pedagogical strategies and delivery. This may include the translation of a pedagogical interaction from one format, for example a seminar, into a form that is appropriate for delivery within an RLO. During network analysis the different stakeholder groups within the RLO-CETL’s communities were able to articulate their roles and were able to see the value of their contribution to the finished product (Morales & Carmichael, 2006).

The third characteristic of a community of practice is that members are empowered. Very

often tutors feel that their role in e-learning development is to hand over their content at the technologist's door and leave. However, the community of practice model adopted here, together with the iterative development process that will be outlined shortly, aims to empower tutors and students to participate and influence all aspects of the development process. This is important as tutors and students not only understand the content that needs to be delivered, but will also have a clear idea of the types of pedagogical approaches that will, or will not work, in addressing these. Network analysis within the RLO-CETL demonstrates empowerment at all levels within these communities of practice. For example, this quote taken from a recent study shows the sense of empowerment that student members of the RLO-CETL have articulated:

Student (2007): Being part of something that is designed to help us. The RLO-CETL really wants us to contribute rather than just saying 'yes, we have students'. But we are actually taking part and getting involved (Windle et al., 2008).

This empowerment has many ramifications. Many tutors and students are encouraged to develop further resources or to experiment with other areas of technology enhanced learning. Perhaps the greatest benefit from this empowerment, however, is the sense of ownership of the RLOs that it engenders (Windle et al., 2007b). This sense of ownership means that tutors and students are more likely to use the resources, undertake research and evaluation around their use, and also, crucially, be more willing to share the resource and actively recommend them to others, thus providing a springboard for reuse. The role that students have developed as advocates for the resources through social networking sites is one of the surprising, unintended consequences of the RLO-CETL project. For example, another student from the recent study states:

Student (2007): I would like to help students reusing the RLOs and developing them for their own courses - that will be fantastic! (Windle et al, 2008).

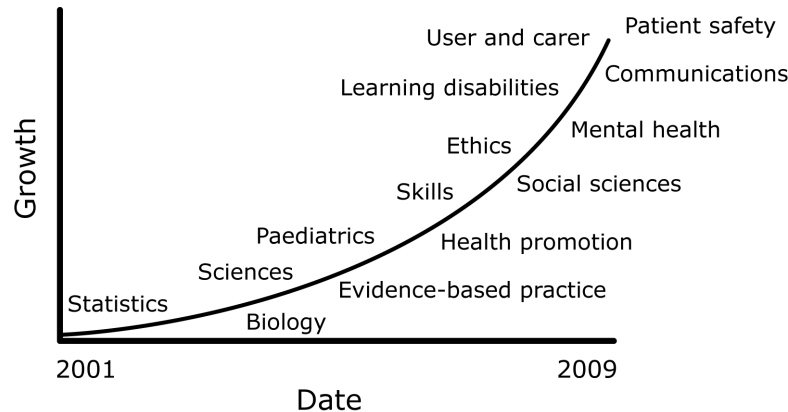
It has been suggested that communities of practice such as those envisaged by Wenger cannot be created; they either exist or they do not (Wenger, 1998). However, our experience is that communities of practice can be facilitated by providing resources, time, spaces, reward and recognition for individuals and groups (Morales, Carmichael, Leeder, Wharrad & Windle, 2007).

Benefits of Community of Practice Approach

Although this approach to e-learning development can be time consuming, there are a number of clear benefits, especially for the development of materials for interprofessional health and social care education. Firstly, placing those on the "pedagogical front-line", namely tutors and students, at the centre of the development process should ensure that the resources produced are highly aligned to real-world learning needs. Data from projects, such as those outlined in this book, suggest that these RLOs have a high degree of alignment with the needs of the learners. Learners consistently rated them very highly in terms of the appropriateness of level, content and pedagogical approaches taken. Consistently they rate questions such as "*this RLO supported my learning*", "*was pitched at the right level for me*", "*introduced new concepts clearly*" or "*was appropriate for my course*" with approval ratings of over 90%. Moreover, these ratings are seen consistently across a wide range of subject areas, despite differences in the design of the RLOs, suggesting that tutors and students are indeed developing materials to meet the specific requirements of their own learner groups (Windle et al., 2007).

Secondly, RLOs developed by a community of practice approach have proved to be a highly

Figure 3. The growth of RLOs within the University of Nottingham School of Nursing, showing the exponential increase in the number of RLOs and number of RLO authors.



effective way of unlocking content and encouraging many into the e-learning development process for the first time. There are a number of reasons for this. The sense of empowerment, control and ownership undoubtedly play a large part, but it is also the granular nature of the resources themselves that helps. It is far easier to commit to developing content for a ten-minute learning package, perhaps involving a few days work, than a more traditional e-learning resource taking several months.

The effectiveness of the RLO development process in enabling many into the e-learning process can be clearly seen by the exponential growth in RLO development within the School of Nursing at the University of Nottingham from 2001-2009 (see Figure 3). The diagram shows an exponential increase in the number of RLOs being developed over this time and the number of tutors becoming involved in the process, from a handful of enthusiasts in the early days, to a much broader spread including many who would not consider themselves comfortable with technology. It is estimated that over 40% of school staff have been involved in RLO development by 2009. Similarly, the subject areas being covered by RLOs has widened over this time (see Figure 3). To start with the subjects that had been traditionally receptive to e-learning, such as biological sciences

and pharmacology were quick to experiment with this new approach, but over time RLO development has spread into areas of the curriculum that were seen as less conducive to e-learning, such as learning disabilities, mental health and social sciences. This has particular relevance to the broad curricula that make up many health and social care education programmes.

By encouraging an increased involvement of staff in e-learning development, the RLO initiative has been seen as a model for institutional change across the RLO-CETL (Cook et al., 2007). The model suggests that there are tipping points beyond which the initiative's further rate of adoption becomes self-sustaining. These tipping points can be seen in the development of a critical mass of RLOs for delivery in programmes and also in the number of individuals becoming involved in the RLO development process. Thus, as a model of institutional change, the RLO development process may have much to offer the growth of interprofessional learning initiatives within the UK and elsewhere.

Perhaps the biggest advantage of the community of practice RLO development model for interprofessional learning is the inclusive nature of the approach. The multidisciplinary community allows different individuals from different fields

or areas of expertise to contribute equally to the development process. These individuals work together to develop a learning resource that reflects the experience and knowledge of each. In doing so each discipline represented can gain a sense of ownership. Moreover, other stakeholder groups can also contribute their knowledge and experience to the learning resource. The involvement of students has already been noted. Indeed, in some project areas, the vocational experience of students working with individuals with a learning disability, for example, has formed the very core of resources aimed at supporting an interprofessional approach to working with this client group and has tackled issues such as communication and person-centered planning (Windle et al., 2008). This methodology has also allowed us to engage with practitioners, practice-managers, service users and carers in the development process. Obviously this is of crucial importance in modern health care education and provides a greater range of learning resources for the students.

Pedagogical Attributes of Learning Objects

When considering best practice for the design of RLOs for interprofessional learning, it is helpful to look at the pedagogical attributes that RLOs display. The facts that the community of practice approach necessitates a move away from high levels of standardization means that designs often reflects the pedagogical preferences of the content authors. This has led to a rich diversity of RLOs designs. Therefore, analysis of existing RLO collections enables us to investigate how different aspects of pedagogy influence factors such as reuse and interprofessionality. However, learning designs within RLOs are rarely explicit. Earlier attempts to classify RLOs tended to focus on their technical attributes or formats, such as the eCornell “*Periodic Table of Online Learning Elements*” (eCornell, 2003), or take a far broader

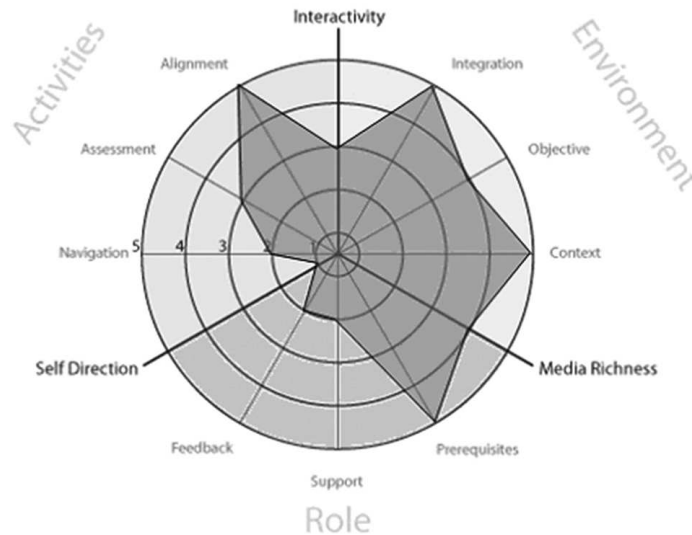
view of what constitutes an RLO as discussed previously (Wiley 2001).

However, as part of an analysis of the ways in which pedagogy affects reusability of RLOs, we have constructed and validated a tool that reviews the pedagogical attributes of RLOs. The tools, known as the learning object attribute metric (LOAM) tool (LOAM, 2007), consist of twelve pedagogical attributes. An example of an RLO scored using the tool is shown in Figure 4. The attributes themselves are derived from the IMS learning design framework (Windle, Wharrad, Leeder & Morales, 2007). IMS Learning Design provides a framework for codifying any instance of learning, from a whole module, to a single learning activity and has been widely adopted by projects that seek to capture learning design, such as the Learning Activity Management System (LAMS 2002).

At its principle level IMS learning design defines a learning instantiation under three major headings: the environment in which the learning takes place, the roles played by those involved in the learning process and the activities undertaken (IMS, 2005). Although the twelve attributes of the LOAM tool were identified with the explicit intention to measure their effect on reuse, many of the drivers and barriers to reusability may equally apply to their interprofessional use. Therefore these attributes will be discussed in relation to the design or selecting of RLOs for use in health care in interprofessional learning.

The attribute called “*objective*” describes the scope and focus of the learning objective addressed by the RLO and the extent to which it is explicit to the learner. The objective can range from small and highly focused to a broader, more diffuse goal. In general, for reuse, a highly focused goal is more appropriate. This tends to make the RLO more portable and clearer from the user’s perspective. Broader objectives tend to lose definition and to be more poorly aligned with the content of the RLO. The same guidelines may apply to the use of resources for interprofessional learning.

Figure 4. An example of the pedagogical footprint generated by the LOAM tool for the RLO “Levels of Measurement” that has been widely used in interprofessional learning.



Here especially, a tight focus is required so that the learning goal can be interpreted by learners coming to the RLO from different backgrounds and cultures. There is a recognized tension in that different professional groups may wish to append different learning outcomes to the same resource to meet the needs of their learners, but the ability of a group to coalesce around a single, jointly agreed objective may well be an important first step in designing truly interprofessional materials.

The attribute called “*context*” describes the degree to which the materials are contextualised for a particular group of learners. This attribute represents a major source of conflict between use and reuse, as outlined above, but in general, reuse is best served by materials that are as context neutral as possible. The same may well apply to interprofessional learning. Here the degree of contextualisation must be minimized below the level at which it would bias or alienate one professional group or another through the use of cultural references, language or terminology. The example of pharmacology has already been discussed, but another example involves RLOs that have been developed in the area of patient

safety and communication for use with all health practitioners. Here, it was important to include examples from a range of professions and ensure that no professional group was used as an example of poor communication.

“*Media richness*” describes the standard and variety of media elements used within an RLO. In general, learners respond well to a resource that contains a rich mix of media elements, with visual and audio components known to support the learning process for health care students (Lynn, Bath-Hextall & Wharrad, 2008). A high standard of media elements also gives the resource a level of professionalism and credibility that impacts on learning. However, care must be taken to ensure that complex media elements do not detract from learning by over burdening it with an unnecessary cognitive load or become too complex to reduce reusability. The production of an authentic environment through the judicious use of media elements is likely to support interprofessional learning. RLOs that take the learner on a journey through simulated living or care environments have proved particularly useful for exploring is-

sues such as safety, and person-centered planning with an interprofessional audience.

The attribute “*integration*” describes the appropriateness with which different media elements have been employed to address specific pedagogical issues and the extent to which they have been combined so that the whole is greater than the sum of the parts. The careful selection of media elements is of particular importance in health and social care. Photographs and videos may be appropriate to illustrate certain techniques, or conditions, whereas in other situations the flexibility or “*distance*” afforded by animations may be more useful. Interprofessionality must recognize that social constructs within media representation may have different meanings for different groups. A cartoon that one professional group might find amusing may be seen as offensive or a barrier to learning in another.

“*Interactivity*” describes the extent to which the learner can engage with the RLO. In order to have an active and engaging learning experience, the learner should be able to engage interactively with the learning object. Linear (or didactic) constructions limit interactivity but may be necessary for effective communication of knowledge. In general, simple but engaging interactions spaced throughout the resource are most appropriate. Where interactivity is included it should be designed to engage all professional groups, or to allow different professional groups to step into the shoes of another. RLOs such as Gateways to Health (UCEL, 2009) and Responses to Sexuality in People with a Learning Disability (University of Nottingham, 2009) are good examples of this approach.

“*Navigation*” describes the extent to which navigation forms an integral aspect of the learning design. Linear or directed navigation can be repetitive and tedious, but more open, non-linear constructs with multiple pathways can be confusing and disorienting. The related attribute of “*self-direction*” describes the extent to which the learner has choice in how they work through the

resource and its activities, and whether they can choose to undertake particular sections. Branching navigation and a high level of self-direction is often selected as an option when materials are developed for diverse groups of learners, such as those within an interprofessional setting, but their use should be carefully considered, as they can have the effect of hiding information from the learner and may actually act to reinforce interprofessional boundaries.

The attribute “*assessment*” defines the level of self-assessment available to the learner, whilst the related attribute “*alignment*” describes the extent to which the assessment elements measure attainment of the learning objective. In general self-assessment is a good aspect of a learning design within an RLO, but this must be gauged. Self-assessment elements have been shown to engender a sense of ownership of the learning process in health care students, especially when grappling with complex multifaceted curricula (Childs, Blenkinsopp, Hall, & Walton, 2005). However, self-assessment may not always be appropriate, if an RLO is used to explore an ethical dilemma or to challenge perceptions for example. An example of such an RLO is a resource entitled “*Should Sarah Smack her Child?*”. This interactive tool is aimed at interprofessional groups studying early years education courses. It invites the learner to listen to a range of stakeholders as they give Sarah their own advice and to contribute to the debate (University of Nottingham, 2009).

The attribute “*pre-requisite*” is another attribute that has a major impact on reuse and is similarly relevant to interprofessional learning. It defines the level of knowledge required by the learner prior to undertaking the RLO. Obviously the pre-requisite level of knowledge in a particular subject area will vary between the different professional groups and the learning facilitator must be mindful of this in preparation. Tools such as glossaries may also help to bridge gaps between different professional audiences.

The last two attributes are “*support*” and “*feedback*.” Support describes the amount of help and support provided to the learner by the content author within the RLO, including help menus, glossaries navigational support, on screen advice etc, whilst the attribute “*feedback*” describes the level of information provided to the learner in response to the learning tasks and assessments undertaken. Generally, the provision of support and feedback is quite low within RLOs despite the fact that a higher level of support is likely to support reuse and in the context of interprofessional learning; customizable help and support may be appropriate to meet the needs of the different learning groups involved.

Attributes described here were designed to review the reusability of learning objects. Other attributes may need to be considered when designing or choosing materials for interprofessional learning. Indeed, colleagues from the Centre for Interprofessional e-learning (CIPeL) CETL are currently developing a series of attributes to meet this need. The attributes identified include authenticity, multiprofessionalism, problem solving, valuing-others and person-centeredness.

FUTURE RESEARCH DIRECTIONS

It can be seen from the brief discussion here, that many challenges still exist in the construction of RLOs for reuse and interprofessionalism, including the ability to produce granular, context-neutral materials, but at the same time provide integrated, contextualized materials. A number of tools are being developed that address these conflicts. As well as commercial tools, some, such as the Umbrella Learning Object (ULO) creation tools are being developed as open source, or open-license software that will be freely available to learning facilitators and tutors (Taylor, Windle & Wharrad, 2008). This allows individual RLOs to be integrated to form a broader learning resource and also allows the addition of contextual elements

to personalize resources for particular groups of learners. Other tools are being developed that allow the adaptation of core RLOs. These so called generative learning object (GLO) templates allow the modification of content to meet the needs of specific learning groups (Boyle, 2006). Finally there is a growing array of rapid e-learning development tools that allow the almost immediate creation of learning objects from existing resource. These include Powerpoint-flash conversion tools and XML driven templating environments such as XERTE (Taylor et al, 2007).

Therefore, there are a number of options available to the tutor to customize materials for interprofessional use. However, whichever of these tools is chosen, it is essential that the pedagogical imperatives outlined above are addressed if the materials created are to be effective in supporting learning and reuse. The future is also likely to see a divergence between RLOs with Web 2.0 enabled functionality which will increase the collaborative nature of learning with RLOs; this will surely benefit the interprofessional audience and will require an extension of the current pedagogical approaches displayed by RLOs.

CONCLUSION

In conclusion, RLOs represent an e-learning format with a great potential for use within the interprofessional setting. A community of practice model provides an approach that has the potential to harness and empower a range of stakeholders in the creation of learning resources. It also has the potential to develop the collaborative sense of ownership of resources, which is central to sharing and reuse. Reusable learning objects themselves, by the very fact that they are designed for reuse also exhibit many characteristics that suit them for use in an interprofessional setting. However, it is the role of the learning facilitator to contextualize these resources and provide the higher levels of

learning designs that is required in the complex environment of interprofessional pedagogy.

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