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# Using reusable learning objects (RLOs) in wound care education: Undergraduate student nurse's evaluation of their learning gain

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## ARTICLE INFO

## ABSTRACT

*Background:* Both nationally and internationally concerns have been expressed over the adequacy of preparation of undergraduate nurses for the clinical skill of wound care. This project describes the educational evaluation of a series of Reusable Learning Objects (RLOs) as a blended learning approach to facilitate undergraduate nursing students learning of wound care for competence development. Constructivism Learning Theory and Cognitive Theory of Multimedia Learning informed the design of the RLOs, promoting active learner approaches. Clinically based case studies and visual data from two large university teaching hospitals provided the authentic learning materials required. Interactive exercises and formative feedback were incorporated into the educational resource.
*Methods:* Evaluation of student perceived learning gains in terms of knowledge, ability and attitudes were measured using a quantitative pre and posttest Wound Care Competency Outcomes Questionnaire. The RLO CETL Questionnaire was used to identify perceived learning enablers. Statistical and deductive thematic analyses inform the findings.
*Results:* Students (*n* = 192) reported that their ability to meet the competency outcomes for wound care had increased significantly after engaging with the RLOs. Students rated the RLOs highly across all categories of perceived usefulness, impact, access and integration.
*Conclusion:* These findings provide evidence that the use of RLOs for both knowledge-based and performance-based learning is effective. RLOs when designed using clinically real case scenarios reflect the true complexities of wound care and offer innovative interventions in nursing curricula.

## 1. Introduction

Wound management within clinical practice has undergone significant change in the past two decades. Increased acuity of care, changing demographics with an aging population and higher prevalence of chronic conditions means that expectations of the competence of nurse graduates in wound management continues to escalate. The global prevalence of people with chronic wounds is predicted to increase substantially in the future (Franks et al., 2016; Posnett et al., 2009). In addition, decision making around wound care is now integral to the nurses' scope of practice (Stephen-Haynes, 2013). Both nationally and internationally, concerns have been expressed over the adequacy of preparation of undergraduate nurses for the clinical skill of wound care.

Issues in nursing education such as inadequate time and resources

for hands-on practice and repetition of skills learnt have been identified (Borneuf and Haigh, 2013; Walker et al., 2013). Deficits have also been identified in underpinning biosciences knowledge (Ylonen et al., 2014; Missen et al., 2016). Lack of evidence-based knowledge and skills can adversely affect wound healing and lead to social, personal, financial and psychological costs on the individual and economic drain on the health-care system (Franks et al., 2016).

In order to cope with rapidly changing health and educational environments, nurse educators must strive to facilitate student competence in wound care through the use of a variety of transformative learning strategies. Computer-assisted learning (CAL) offers some possible solutions. CAL products provide flexible, asynchronous teaching-learning environments that can if reused, offer long-term value (Williams et al., 2015; Blake, 2010). This article describes the

**Table 1**
Reusable learning object instructional design pedagogy.

| Constructive learning theory (individual) | RLO design attributes | Implication for learning |
|---|---|---|
| Learning is understood as achieving understanding through active discovery. | Presentation of learning opportunities that facilitates progressive discovery of relevant concepts/skills related to wound care | Ownership of the learning task. Active construction and integration of learning using multimodal content, learning activities, assessment and feedback. |
| Emphasis on learner control. | RLO provides an interactive environment with learning activities that allow experimentation and discovery learning. Flexibility to engage in learning at a time, pace and place that is appropriate for the learner. | Promotes learner engagement, motivation and active learning. |
| Constructive alignment. | Learning outcomes are aligned with purposeful activities and assessment tasks | Facilitates self-regulated learning. |
| Context dependent learning. | Anchored learning in meaningful content (real video and photograph footage). Authentic tasks based on real-world, case-based exemplars. | Enhances deep learning through activities that are personally meaningful for application in professional nursing practice. |
| Construction of knowledge | Active inquiry tasks: | 'Discovery' is facilitated by providing the necessary resources |
| Learners construct their knowledge through active inquiry and increasing complexity | Reflect on pre-existing knowledge and experiences of learner. Integrated new information and problem solving learning tasks (reflection and drag and drop activities) Increase complexity of activities by presenting new problems and situations e.g. wound care dressing choice etc. | Knowledge is actively constructed & learning is presented as a process of active discovery |
| Cognitive scaffolding | Emphasis on assessment for learning. Create situations where the students feel safe questioning and reflecting on their own processes. RLOs aided the development of pattern recognition by e.g. offering a number of attempts to categories tissue types, to grade exudate volume etc. Providing scaffolding at the right time and the right level Feedback: Support learning tasks with follow up conceptual clarity | Strengthen the learner's tendency to engage in intentional learning processes, especially by encouraging the strategic exploration of errors, reflection and feedback. |
| Cognitive theory of multimedia learning | Dual channel principle –separate channels for processing verbal and pictorial information – using both reduces memory overload. Limited capacity principle | RLOs contain multiple means of presenting information - written, aural and visual. Minimal text on slides when instructor discussing an image/diagram. |

evaluation of an innovative approach to supplement undergraduate learning of wound care – the development of a series of wound care reusable learning objects (RLOs).

RLOs are digital learning activities that can be integrated into modules and can be reused to attain module outcomes (Billings, 2010). Each RLO is generally small in size and is highly visual. Learning outcomes are provided and sufficient content is included to meet these. The RLO also contains a practice component in which the learner must apply the content in a clinical context and self-test elements with formative feedback. RLOs are flexible, being accessible anytime and anywhere. They can be used alone or to support in-classroom learning, blended learning, or online instruction outside the classroom prior to face-to-face sessions (flipped learning) (Khanova et al., 2015). They have been evaluated as an effective use of time and have been shown to appeal to nursing students (Brooks, 2015; Windle et al., 2011; Williams et al., 2015; Billings, 2010).

The wound care RLOs were designed to facilitate constructivist learning that fosters active student engagement in their own learning (Kala et al., 2010). Students construct knowledge and meaning based on pre-existing knowledge and experiences and through interaction with new information. The developed RLOs provided inquiry methods to investigate the topic of chronic wound healing. The RLO design principles were also informed by cognitive theory of multimedia learning (Mayer, 2009). This theory endorses the use of both authentic visual and aural information with interactive formative assessment to facilitate the learner to build conceptual connections and attain learning gains.

### 1.1. Aims of This Study

The aims of this study were:

1. To evaluate the educational attributes of the wound care RLOs with third year undergraduate nursing students to identify their perceived learning gains in terms of knowledge, performance and attitudes.
2. To evaluate the media attributes of the RLOs to identify enablers of learning.

### 1.2. RLO Development as an Educational Intervention

While a number of repositories exist of predeveloped RLOs we were unable to find one dealing with chronic wound care in the step-by-step procedure of the interactive resource presented here. We therefore undertook this task during 2014–2016 using a well-established methodology (Windle and Wharrad, 2010). In order to capture the necessary quality, content and context of the multimedia elements that we required, ethical approval was obtained to produce a number of video recordings of tissue viability nurses (TVNs) carrying out wound care on people in our partner hospitals and clinics. This video footage was edited and formatted, incorporating written content, images and voice over to highlight what was being demonstrated during the various video clips. The resources were reviewed by an expert panel composed of a TVN, two nurse physiologists and an educational technologist at two points in time. This was to ensure the usability and appropriateness of media to explain the concepts and to assess the quality and relevance of the content.

In total four RLOs were developed. The first provided an introduction to chronic wounds, discussing their aetiology. A venous leg ulcer scenario was used as an exemplar. The second covered chronic wound assessment principles; the third the principles of chronic wound management and the fourth explored aftercare management. The RLOs were designed to facilitate the user's learning journey by offering flexible pathways. Students could choose to work through them in a