Abstract

Work-integrated learning (WIL) is learning that emanates from the integration of workplace experience and university knowledge. The inclusion of WIL in formal qualifications at universities is becoming increasingly common, as institutions of higher education strive to produce employable graduates. The University of South Africa (UNISA) is an Open Distance Learning (ODL) institution that offers WIL in several qualifications. However, the incorporation of WIL into the computer science and information systems curriculums within the School of Computing (SOC) is largely absent.

To satisfy the changing community and student learning needs, this paper proposes a theoretical model of WIL to empower students with real-life experience aligned to the knowledge gained at the university as well as to strengthen partnerships with local communities and industry. There are several classifications of WIL including community service, co-operative education, internships and professional work placement. The focus in this paper is on community service, otherwise known as community engagement (CE) at UNISA. A CE initiative of the School of Computing (SOC) called Computing ProBono is used as an illustrative example to demonstrate the plausibility of the proposed model. This CE initiative uses the principles of socially relevant computing (SRC), a paradigm that empowers students to solve problems of personal interest, as well as problems that are important to society at large. The proposed WIL model will enable students to assist the community with their social challenges while still augmenting students learning.

Keywords: Open Distance Learning (ODL), Work Integrated Learning (WIL), Socially Relevant Computing (SRC), Community Engagement (CE), Simulated Work Experience (SWE)
Introduction
The University of South Africa (UNISA) is the largest dedicated Open Distance Learning (ODL) organisation in South Africa, and is dedicated to providing quality education with the vision of linking the student and the lecturer (Wessels, 2012). UNISA has six prestigious colleges offering a wide range of high quality academic and vocational programmes. The focus of this paper is on the computer science and information systems curriculum within the School of Computing (SOC).

The objective of computing (i.e. computer science and information systems) modules at UNISA is to prepare students to be socially responsible, knowledgeable and proficient in a computing-related profession. One mode of preparing students for industry and to enhance their chances of employment is through Work-integrated Learning (WIL), a "strategy for applied learning that integrates the rigor of an accredited academic program with periods of supervised and relevant experience in the workplace" (Jancauskas et al., 1999). Unfortunately, due to the distance teaching mode at UNISA, face-to-face contact between academic staff and students is limited and the involvement of industry in WIL is largely absent, particularly in the SOC. Nevertheless, an opportunity to expose students to WIL through community engagement (CE) initiatives exists in the university. CE is one of the core functions of the university, where both the staff and students are encouraged to participate on a regular basis.

To afford students the opportunity to gain workplace experience, this paper proposes a WIL model based on a CE initiative within the SOC. This CE initiative follows the principles of socially relevant computing (SRC), which according to Buckley et al (2008), is an approach, whereby students are presented with problems of societal and interpersonal relevance, the emphasis being on learning computing for a cause. The objective of this model is to create an environment of socially responsive and employable graduates as well as to strengthen partnerships with the industry and the community.

To achieve this objective, the paper is structured around four objectives. First, a review of the theory surrounding ODL and WIL at UNISA is presented. Secondly, an overview of CE at UNISA is discussed. Thereafter, an overview of SRC is presented because the CE initiative of the SOC, Computing ProBono is based on societal and interpersonal
development which is one of several outcomes of SRC. Finally, the integrative model for WIL within an ODL context is presented and the implications for theory and practice are discussed.

**WIL in an ODL environment**

Unisa (2008) defines ODL as "a multi-dimensional concept aimed at bridging the time, geographical, economic, social, educational, and communication distance between student and institution, student and academics, student and courseware and student and peers. Open distance learning focuses on removing barriers to access learning, flexibility of learning provision, student-centeredness, supporting students and constructing learning programmes with the expectation that students can succeed."

Learning at UNISA is defined as "an active process of construction of knowledge, attitudes and values as well as developing skills using a variety of resources including people, printed material, electronic media, experiential and work-integrated learning, practical training, reflection, research, etc. Learning is also associated with personal change and empowerment as an aspiration to improve oneself in order to help others" (UNISA, 2008b).

WIL as one of the several learning approaches at UNISA is a "strategy of applied learning that integrates the rigor of an accredited academic program with periods of supervised and relevant experience in the workplace" (Jancauskas, et al., 1999).

WIL, also referred to as experience-based learning (Beard et al., 2002), is described as a partnership among students, educational institutions and employers, with designated responsibilities for each party (Abeysekera, 2006). At UNISA, WIL is regarded as a form of experiential learning where experiential learning is an educational method to expose students to realistic experiences (UNISA, 2011). The other form of experiential learning at UNISA is simulated work experience (SWE) and this "encompasses learning and teaching technologies used to create artificial learning environments to enhance or replace a student’s actual experience with the world of work through simulations. For example, live projects, case studies, employer talks, role play, mentoring, e-simulations" (UNISA, 2011). The focus of this research is only on WIL as a form of experiential learning and not on SWE as no work has at this stage been done within the SOC on creating artificial learning environments.
Numerous studies have illustrated that WIL programs provide important benefits for students, employers and higher education institutions alike (Braunstein & Loken, 2004; Dressler & Keeling, 2004; Weisz & Chapman, 2004). Fallows and Stevens (2000) state the most important benefit of a WIL program is that it builds employability skills of students into the higher education curriculum.

WIL programs are perceived as components of undergraduate study across a host of academic disciplines, and although the terminology used to describe these programs differs, the underlying component is student involvement in a practical placement (Heerde & Murphy, 2009). WIL is of equal importance as other modes of teaching and learning at UNISA (UNISA, 2012). The curriculum of some of UNISA’s qualifications includes one or more compulsory WIL modules. Examples of these qualifications include Agricultural Management, Animal Health, Chemical Engineering, Civil Engineering, Consumer Science – Hospitality Management, Electrical Engineering, Horticulture, Industrial Engineering, Mechanical Engineering, Mining Engineering, Mine Surveying, Nature Conservation and Surface Mining. UNISA also offers the Bachelor of Science (BSc) degree with 44 distinct areas of specialisation (Studies, 2012). However, there is no WIL component in the computing curriculum.

Abeysekera (2006) outline several types of WIL approaches. These include an ad-hoc approach, where students find or are found a work placement, cooperative education which is a contractual arrangement between the faculty and an outside agency, the development of work based programs for organisations, an approach whereby the degree is taught at the workplace, an internship program and a service learning or community service performed through the faculty setting. The focus of this paper is on service learning, "a structured learning experience that combines community service with preparation and reflection. Students engaged in service-learning provide community service in response to community identified concerns and learn about the context in which service is provided, the connection between their service and their academic coursework, and their roles as citizens" (Council on Higher Education (CHE), 2011). Service learning is known as community engagement at UNISA and this is discussed in the ensuing section.
Community Engagement

Community engagement is one of three core responsibilities of higher education, together with research and teaching (Education, S. A. C. o. H., 2010). The Council of Higher Education further adds that in South Africa, although there are clear policy directives stating that community engagement is an important task, it has nonetheless been neglected (Education, S. A. C. o. H., 2010).

The community engagement (CE) policy of UNISA states that CE refers to "initiatives and processes through which the expertise of the institution in the areas of teaching and research are applied to address issues relevant to its community. Community engagement typically finds expression in a variety of forms, ranging from informal and relatively unstructured activities to formal and structured academic programmes addressed at particular community needs, and some projects might be conducive towards the creation of a better environment for community engagement and others might be directly related to teaching and research" (UNISA, 2008a). The focus of this paper is on unstructured activities with a view of formalising this activity as one of several approaches of WIL. This is important as WIL is required to enhance student learning by virtue of "innovative curricular, pedagogical and assessment forms" (Council on Higher Education (CHE), 2011) which means that CE

Computing ProBono is one of several CE and outreach projects in the School of Computing (SOC). This project is intended to exploit the computing and research expertise of the SOC staff, students, and industry stakeholders to develop open Information and Communitarian Technologies (ICTs) solutions that address social and humanitarian challenges. The mission of this project is to collaborate with local communities, subject matter experts, government, non-governmental organisations (NGOs), local schools, and others to design and build open ICTs that have the potential to address social and humanitarian challenges.

One of the main activities of the project is the hackathons. In brief, hackathons are defined as marathon coding events that bring together different stakeholders to build lightweight and yet fully operational prototypes that address technological challenges within a particular domain (Leckart, 2012; NASA, 2010; RHoK, 2009; Watters, 2012). The emergence of hackathons date back to 1960 (Levy, 2010). However, their extensive use within the software development domain started to emerge in the 90’s when the use of computer software became significant. Today,
Hackathons are a norm in large organisations such as Facebook, Yahoo, Google, and Microsoft. These events are hosted in these large organisations for many reasons, such as to build new solutions, to empower a community of developers, to entice developers to embrace the latest technologies, and to recruit bright software developers into these organisations.

Since the main aim of the Computing ProBono project is to address social and humanitarian challenges; which is one of the main objectives of SRC, this CE project adopts the principles of SRC discussed in the following section.

**Socially Relevant Computing (SRC)**

Research on instruction in computer science education reveals the benefits on student comprehension and retention of design projects that reflect real-world experience and offer complicated and engaging challenges (Dannelly & Steidley, 2001; Sikkel et al., 1999). To address the importance of incorporating real-world experience in computer science, Buckley et al (2008), introduced the concept of socially relevant computing (SRC), an approach, whereby students are presented with problems of societal and interpersonal relevance, the emphasis being on learning computing for a cause.

SRC requires a different approach to computing instruction ranging from problem representation and modelling, addressing the key concepts of computing and the pedagogical order in which to cover them (Buckley, et al., 2008). This new approach according to Buckley et al (2008), teaches students how to learn about new domains, how to work effectively in teams with scientists from varying disciplines as well as how to evaluate the social or ethical aspects of their solutions. This is important because Goldweber et al (2010), points out that students should in addition to possessing significant technical skills also be able to assess the societal impact of their work, commit to standards of professional ethics and obtain the life skills necessary to undertake on-going professional development in their discipline. Adding a social relevance dimension to the curriculum addresses the common complaint that students are not sufficiently prepared for design challenges in their careers in industry Buckley et al (2008).

SRC solutions have been implemented successfully and examples cited include the incorporation of open-source humanitarian projects (Morelli et al., 2009), and the Humanitarian Engineering program (Moskal et al., 2008) in the
computer science curriculum. The Computer Science and Engineering Department at the University of Buffalo adopted the use of socially relevant projects into their design courses for Computer Engineering students in the area of assistive technology for the disabled (Buckley et al., 2004). Examples of the projects they worked on included a UB Talker (an augmentative communication device for the speech-impaired), an interactive sensory system; which helps children with developmental disabilities learn choice making skills, a remote controlled wheelchair, and a single click user interface enabling quadriplegics to use a computer. A number of benefits were noted from these projects including the refinement of students’ technical and non-technical skills, the generation of interest from prospective students, the revitalization of students whose academic careers were at risk and the embracement of interdisciplinary experience (Buckley, et al., 2004).

The Humanitarian free and open source software (FOSS) disaster management system focused on involving students on developing and deploying real-world projects (Morelli et al., 2010). This project had a number of benefits including engaging students with technologies they cannot experience in traditional classrooms, educating students with real-world experience that they can later use in industry and working in teams therefore eliminating the concept of a solitary programmer (Morelli, et al., 2010).

All the above benefits illustrate that there are core computing principles that students can be taught, in a way that is engaging, stimulating, and motivating with opportunities for creativity, innovation, and intellectual development. At the same time, students are presented with a new approach for solving problems of personal and societal interest.

The hackathons events were developed using the same principles of SRC. To date, two hackathons in December 2011 and June 2012 were hosted (College of Science, 2012). These events attracted over 80 participants comprising UNISA computing students, students from other institutions, subject-matter experts, researchers, analysts, developers, and local communities, who gathered and collaborated to tackle different social challenges. The challenges presented in the hackathons were addressed in teams of about 2-8 members with different level of expertise, from novice to experts. Students highlight that they attend such events to "learn, and practically apply what they have learnt in the classroom” in practice". It was clearly evident that students participate in such activities for the purposes of
"conscious learning, skills transfer, and at the same time getting the opportunity to make sense of the theory in a real-life setting".

Some students who participated also indicated that the whole concept of hackathons was quite useful as it provided them with a chance to "learn from expert developers", but also an opportunity to be part of project teams that are capable of delivering practical and socially relevant technological solutions within a short space of time. Observations were also that such events provide a great platform for WIL.

Based on the above review and from the literature review of the preceding sections, a theoretical WIL model for computing within the SOC is proposed. Computing ProBono is used as an informal means to evaluate the plausibility of the proposed model. Although this model is developed specifically for computing within the SOC, this model can serve as a generalised model for WIL using a CE approach within an ODL environment.

**Proposed Model and Discussion**

In the absence of a WIL component and by analysing the aforementioned discussion, a theoretical model of WIL for an ODL learning environment is proposed. Figure 1-1 illustrates that there are several learning components at UNISA including people, printed material, electronic media, WIL, practical training, reflection, and research. The people component includes the academic staff that is core to the process of teaching and learning. The printed material refers to the prescribed texts and tutorial matter, whilst electronic media encompasses the Virtual Learning Environment (VLE) of the university where students have access to podcasts and social media technologies, such as blogs for learning and communication. Practical training includes hands on training for computer literacy classes or programming modules. On the other hand reflection includes portfolio activities and research entails the postgraduate modules where students are required to write research reports or complete Masters and Doctoral degrees.
The WIL mode of learning has several dimensions including an ad hoc approach, cooperative education, work based programs for organizations, internship and community engagement. Community service, otherwise known as community engagement at UNISA can further be subdivided into two aspects according to the formal definition of CE at UNISA. The first aspect addresses formal community engagement that contributes to teaching and research. The second aspect is informal/unstructured CE aimed at addressing community needs. For the informal aspect of CE, two hackathon events under the auspices of the Computing ProBono project were discussed for illustrative purposes.

From the review of the hackathon events, we posit that CE initiatives are a potential environment where students in computer-related domains could acquire real-world experience, especially when involved in short-term projects that deliver demonstrable computer-related solutions (e.g. mobile application prototypes) as observed from the different hackathons events hosted at UNISA. The hackathon events were built along the principles of SRC, and derived the benefits of SRC; which was to present students with a new approach for solving problems of personal and societal interest that is engaging, stimulating, and motivating with opportunities for creativity, innovation, and intellectual development.
Finally, it is also important to note that the involvement of different stakeholders is essential in making the WIL model effective in any ODL environment. As depicted in Figure 1-1, the main stakeholders are the university (i.e. staff), industry, subject-matter experts, and of course the students. The involvement of the local communities is also critical as it is expected that they would understand the social challenges affecting them better than the students, universities or even industry partners.

WIL as defined by the experiential learning policy of UNISA consists of activities that are assessed by the university and contribute to exit-level outcomes of a qualification (UNISA, 2011). This means that the CE initiative must form part of formal tuition at UNISA in order to be considered as one of several approaches to WIL.

Incorporating WIL as a formal part of a qualification will require cognisance of the Higher Education Qualifications Framework (HEQF) of South Africa, gazetted as policy in terms of the Higher Education Act, by the Department of Education where it is stated that: "It is the responsibility of institutions, which offer programs requiring WIL credits to place students into WIL programs. Such programs must be appropriately structured, properly supervised and assessed" (Education, D. o., 2007). This will require considering the Council of Higher Educations guidelines on curriculum design and development for WIL, teaching and learning for WIL, assessment for/of WIL, partnerships for WIL and the management of WIL (Council on Higher Education (CHE), 2011).

Additionally, it will be necessary to consider the Higher Education Quality Committee (HEQC) criteria related to work integrated learning, specifically with regard to accreditation of programs/qualifications (Council on Higher Education (CHE), 2004b) and institutional quality assurance audits (Council on Higher Education (CHE), 2004a).

**Conclusion and Future Research**

This paper proposed a WIL model using a CE initiative that adopted the principles of SRC as a new approach to integrating one aspect of WIL within a computing curriculum. An analysis of the various aspects of learning, several dimensions of Work-integrated Learning (WIL) and community engagement (CE) initiative coupled with the principles of socially relevant computing (SRC) led to the development of a model of WIL within an ODL environment. The hackathon events of the Computing ProBono project illustrated the possibilities of the proposed
WIL model. This illustrated the informal aspect of CE. However, for CE to be a recognised aspect of WIL, it needs to be formalised as part of the curriculum where students are assessed. Guidelines on how to do this in terms of following the correct policy documents were outlined.

The primary purpose of WIL at UNISA within the SOC is to augment student learning. WIL is an umbrella term for a host of approaches and strategies that incorporate academic theory and knowledge with relevant work practice within a curriculum decisively designed to achieve explicit educational outcomes. WIL aspects must be designed so that learning experiences are integrated within the course and are relevant to the learning outcomes of the overall course. All aspects must have a clearly defined set of learning outcomes which take into account advice and standards from professional bodies, employers and industry, the university’s graduate attributes, and must comply with the relevant university policies.

In this paper, only one dimension of WIL (Community Engagement) was illustrated, where students participated in the development of socially relevant solutions working with industry experts and local communities. In future, several other dimensions or the integration thereof could be explored.
References


