SACLA/CSERC'16 Joint Conferences

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BOOKLET OF ABSTRACTS

compiled by *Stefan Gruner* (University of Pretoria)

Please note:

- Each of the joint conferences will independently publish its own post-proceedings *after* the event. The (co-)authors of the *accepted and presented* papers will receive detailed revision instructions in due course.

- The conferences are co-located with the JCSE *Workshop on IT Skills Shortage in South Africa*, independently organised by the Johannesburg Centre for Software Engineering affiliated with the University of the Witwatersrand.

The Joint SACLA/CSERC'16 Invited Keynote Lectures

- **On the Morality of Teaching Students IT Crime Skills**
  M. Olivier (molivier@cs.up.ac.za)

  A superficial introduction to the world of viruses, worms and other malware is often sufficient to get them dreaming about the potential power wielded by those technologies. One needs about a minute to teach them how to build a powerful Trojan Horse, how to distribute such a construction as targeted malware and how to monetise the few minutes they invested in such an effort. Such teaching is rewarding since it is one of the few examples where many students immediately apply their new skills to impress friends. Of course the intention is not to make them criminals, but to gain the deep understanding of issues that would otherwise require them to spent hours with books that discuss abstract concepts that often remains abstract. It is widely accepted that crimes occur where means, motive and opportunity meets. In my quest to increase their understanding, I have just provided them with the first of this triad. The other two are often added in due course by life itself. Clearly one has to ask whether a computing educator should ever even consider teaching students skills that may be abused in this manner. Many counter arguments are well known. One such argument is that those who will abuse power will acquire the knowledge whether they are taught or not. An extension to this argument points out that it is only possible to protect society if the protectors are a step ahead of the wrongdoers, and teaching the 'good' students such skills is necessary. While it is impossible to distinguish easily between those with good and evil intentions, teaching everyone may at least level the playing field. In this keynote lecture I argue that knowledge to harm and knowledge to help overlap in many professional contexts. The lecture argues questions on the morally of imparting potentially malicious knowledge should differentiate between imparting it to those entering a profession and imparting it to the masses. While this does not prevent the professional from abusing knowledge, it is argued that the benefit to society will outweigh the harm. In the non-professional context little benefit is likely to accrue to society, but opportunistic abuse of knowledge already acquired is significantly more probable than the possibility of someone purposefully acquiring and abusing such knowledge. In many disciplines, such as medicine, the distinction is easy to make between those who will enter a profession and others. In computing that distinction is far less obvious. Hence imparting the power of knowledge has to be linked to increasing the professionalism of those who are provided with such power. Unfortunately, professionalism is not only determined by teaching, and the question thus becomes one of asking to what extent professionalism can be imbued through teaching. Such insight begins to delineate the extent to which the power of potentially harmful knowledge ought to be shared.

- **Teaching Informatics in North America: Jugglers Wanted**
  B. Travica (bobtravica@gmail.com)

  Teaching informatics at the university level in North America is challenging. The teacher can be compared to a juggler performing before spectators composed of students, adminis-

trators, academics, business, and government. The juggler strives to keep in the air multiple balls that cross the path. He throws up a student ball that, in turn, may collide with a customer ball. Then, the teacher tries to teach technology, but this move crosses the path with the learners' craving for fun. The juggler aims at efficiency of technical education, while facing limited technological support. Similarly, he/she champions wishes for trendy technology, which get juxtaposed to funding limitations that administrators inevitably impose. The teacher-juggler also keeps throwing tirelessly a ball of academic self-identity, but it inevitably confronts the balls of identity attributed by administrators and other stakeholders. Attempting to respond to requirements of the dynamic field of informatics, the teacher further endeavors to evolve the academic self-identity. However, this ball crosses the path with the ball of quick fixes originating both in an out of the informatics discipline. The presentation will discuss all these challenges and sketch prospects of teaching informatics in North America.

SACLA'16: The 45th Conference of the Southern African Computing Lecturers' Association

- **A Case Study in the Use of the Five Step Peer Evaluation Strategy to Improve a First Year Computer Literacy Course**
  M. Tsietsi (m.tsietsi@ru.ac.za)
  In this paper I recount my experience conducting a comprehensive five step evaluative exercise which was aimed at collecting feedback from various sources in order to help inform future teaching interventions for a first year computer literacy course in a South African university. The exercise centers on a focus group study that was conducted with a number of students who had completed the course between 2013 and 2015 and solicited their feedback on the basis of their own personal experiences. The five step process included collecting feedback from a critical peer as well as the author's own insights. The study was prompted by the author's realization that feedback is most often mistaken for evaluation whereas evaluation is better conceived as the triangulation of various sources of information. The use of a focus group study instead of the common feedback method of the questionnaire also helped engage the students more robustly and was better suited as a tool to collect a richer set of data. The study yielded useful insights which have implications for teaching and learning activities, assessment of student learning and the curriculum.

- **A Comparison of E-Assessment Assignment Submission Processes in Introductory Computing Courses**
  M. Koorsse & *M. Taljaard* & *A. Calitz* (andre.calitz@nmmu.ac.za)
  Students completing university education programs are generally required to complete an Introductory Computing Course in their first year of study. Introductory Computing, also referred to as Computer Fundamentals or End User Computing, are theoretical and

practical in nature and the courses require students to acquire certain practical skills during practical laboratory sessions. Due to the large number of students completing the Introductory Computing courses, institutions are introducing and increasingly utilising e-learning systems and e-assessment systems. Automated Grading Systems (AGSs) are utilised as part of the e-assessment systems in order to make the grading process more manageable and provide more thorough assessment and feedback to students. Research generally focused on e-assessment from an educator or instructor's perspective. In this study, the students' perceptions of e-assessment were evaluated, exploring different options with regards to the submission and assessment of MS-Office documents as part of the Introductory Computing course. The study identified the 'best' method of submission from a students' perspective considering various factors and comparing three different submission methods. The results highlighted suggestions for improving the on-line submission system and improving the usability of the e-learning Moodle system. The results could assist educators and instructors utilising e-assessment systems in improving the submission and marking processes, in any course where files are required for submission.

- **Assessing Programming by Written Examinations**
  K. Halland (hallakj@unisa.ac.za)
  This position paper discusses the validity, pros and cons, and limitations of assessing programming courses by means of written examinations. The author describes the various learning outcomes of programming that should be covered in a valid assessment of a student's programming skills, and then discusses how, and to what extent, these learning outcomes can be covered in a written examination.

- **Code Pathfinder: A Stepwise Programming E-Tutor Using Plan Mirroring**
  M. Durrheim & *A. Ade-Ibijola* & *S. Ewert* (sigrid.ewert@wits.ac.za)
  A significant problem in Computer Science Education is introducing students to programming. Many novice programmers show difficulties in mastering the basics of writing programs. Many students may abandon their study of Computer Science due to these problems. Intelligent Tutoring Systems have been developed to provide guidance and feedback to students. Previous systems require the instructor to prepare extra documentation for the software to function. This creates more work for lecturers who wish to implement such a system. We have developed an Intelligent Tutoring System that will guide a student step-by-step through the writing of simple programs in the language of C++. It will also provide feedback on any mistakes they make. This system will require only a correct version of the code for it to develop its feedback scheme.

- **Criteria for Evaluating Automated Grading Systems to Assess Microsoft Office Skills**
  M. Koorsse & *A. Calitz* & *J. Zietsman* (andre.calitz@nmmu.ac.za)
  Higher Education Institutions (HEIs) generally require first year students to attend and complete an Introductory Computing Course (ICC) during their initial year of study. An ICC

requires students to acquire computer literacy skills generally using MS-Office. The topics covered in these courses include basic skills in word-processing, spread sheets, power-point presentations and database management systems. Initially ICCs were presented by means of lectures, practicals and tutorials. Increasingly HEIs are utilising e-learning environments to facilitate teaching and learning in Introductory Computing Courses due to the large number of students required to complete the courses and acquire the required IT skill sets. HEIs have further introduced e-learning platforms and Automated Grading Systems to facilitate the learning and examination of IT skills in these courses. The use of an Automated Grading System (AGS) can significantly enhance the learning process of computer literacy skills in ICCs and make the grading process manageable and provide more thorough assessment. Criteria for the development and selection of an AGS have been provided in literature studies. This paper builds on previous research and provides a detailed set of criteria that was utilised to evaluate three commercially available AGSs as well as AGSs developed in research. The results highlight the features, benefits and limitations of the AGSs evaluated. The study provided an extended list of criteria for evaluating an AGS and HEIs can use the research findings to assess and evaluate AGSs utilised by institutions presently or in the future.

- **CS and IS Alumni Post-Graduate Course and Supervision Perceptions**
  A. Calitz & J. Greyling & A. Glaum (andre.calitz@nmmu.ac.za)
  Stakeholders in academic departments include Faculty, Alumni, Advisory Board members, current students and employers. Stakeholder analysis provides information that academic departments can utilise to evaluate their program offerings, post-graduate supervision quality and program relevance. Alumni can provide valuable feedback to Computer Science (CS) and Information Systems (IS) departments sharing relevant information of their experiences during their studies at an academic institution. CS and IS Departments can assess how effective an institution's academic programs are in preparing their graduates for a successful career in the ICT industry and how the Alumni experienced their studies in a specific academic department. This study focuses on CS and IS post-graduates' (Alumni) perceptions of their education experience at an academic institution and in a CS and IS department. The study further focuses on post-graduate courses they studied, their relevance and if the academic program adequately prepared them for a career in the ICT industry. The supervision of their post-graduate research was further investigated as well as their overall university experience. The results of the study indicate that the Department of CS and IS provided the required courses for employment in the ICT industry at the specific time they completed their studies. This research could assist academic departments in acquiring Alumni feedback on their academic experience at the institution and improve post-graduate supervision practices.

- **Effective Integration of a Mobile Phone-based Student Response System to Enhance Student Engagement in an Undergraduate Computer Science Classroom**
  F.M. Radebe & L. Nel (liezel@ufs.ac.za)

Classroom learning experiences are often hindered by a lack of student participation and superficial interactions with the course content. Student engagement is essential in ensuring that students take an active role in their own learning experiences. The synergy between active learning and motivation is a principal requirement to reach the desired student engagement level in classroom teaching and learning activities. In this study, a mobile phone-based student response system (M-SRS) was used to collect student responses to classroom quiz questions and provide aggregated results as feedback. Firstly, an instructional strategy was devised to guide the effective integration of the M-SRS as part of classroom activities. Secondly, a case study was conducted at a selected South African university to investigate the effects that the integration of a mobile phone-based student response system (M-SRS) had on student engagement in an undergraduate Computer Science classroom. Analysis of the collected data indicate that the utilization of the M-SRS supported active learning and increased students' motivation to participate in classroom activities. The instructional strategy served as an effective guide for instructional activities and helped to identify instances that could sabotage the facilitation of student engagement.

- **Enterprise Resource Planning (ERP) Teaching Challenges faced by Lecturers in African Higher Education Institutions (HEIs)**
  K. Mahanga & *L. Seymour* (lisa.seymour@uct.ac.za)
  Enterprise Resource Planning (ERP) is considered a scarce graduate competence, and yet a requirement in industry due to ERP pervasiveness. In response to this requirement, university curricula such as the international information systems 2010 curricula has included ERP courses. Yet most African universities have struggled to integrate and teach technology due to challenges such as poor technology infrastructure. Hence developing ERP courses would come with major challenges. The aim of this research was therefore to identify challenges of teaching ERP in African Higher Education Institutions (HEIs). The study was exploratory and adopted deductive and inductive approaches to identify the challenges in cases from Namibia and Tanzania. A number of challenges proposed from the literature were confirmed such as financial constraints and insufficient technological infrastructure, and new challenges emerged such as course scheduling challenges and dealing with diverse students such as part-time and distance learning students. The study proposes strategies to deal with these challenges.

- **Flipping Computer Architecture**
  H. Suleman (hussein@cs.uct.ac.za)
  This paper reports on an experiment with a flipped classroom for a Computer Architecture course. In a flipped classroom, students access content out of the classroom and then engage in a discussion in-class, rather than the other way around. This seemed like an ideal strategy for a course that can easily focus on the minutiae of architectural details and computer history. The results showed that students liked the interactive and practical aspects of the course but were particularly negative about pre-lecture readings. These results suggest that students need to learn how to learn in different ways.

- **Grit and Growth Mindset among Highschool Students in a Computer Programming Project: A Mixed Methods Study**
  D. Kench & S. Hazelhurst & F. Otulaja (kenchd@stbenedicts.co.za)
  This paper investigated the effect of grit passion and perseverance for a long term goal and growth mindset in Grade-11 highschool pupils as they coded a non-trivial programming project in Java over a six week period. Pupils were guided through the stages of the development of a programming project by the teacher and were given a rubric describing the criteria for the project's assessment. The project was scaffolded and was provided with support examples. Assessment was frequent and detailed.

- **Introducing Health Informatics as an Elective Module in an Information Systems Honours Degree: Experiences from the Rhodes University**
  G. Foster & J. Nash (g.foster@ru.ac.za)
  A priority within South Africa's eHealth strategy is the development of skills needed to implement and support health information systems. In view of the time frames involved in creating and delivering new undergraduate curricula, a feasible short-term approach to capacity building is to equip Information Systems (IS) graduates with relevant knowledge of healthcare systems and eHealth technologies. The IS Department at Rhodes University introduced an elective module in Health Informatics within their one-year Honours program, aimed at preparing IS students for careers in eHealth. This paper outlines the module content and insights gained from student feedback.

- **Reflections on a Community-based Service Learning Approach in a Geo-Informatics Project Module**
  S. Coetzee & V. Rautenbach (serena.coetzee@up.ac.za)
  Geoinformatics (also known as geographic information science) is the science and technology that underpins the collection, representation, processing, analysis, visualisation and dissemination of geographic information. Such information is hugely valuable in solving environmental and social problems in society. In this paper we reflect on a community-based service learning approach in a third year geoinformatics module. Students mapped an informal settlement, captured information about dwellings and conducted a number of studies in support of environmental and social problem solving. The aim was to raise awareness of social issues, to understand students' sense of social responsibility and their understanding of the role of geoinformatics in solving community problems. After completion of the module, we conducted in-depth interviews with ten students. The results confirm the value of community-based service learning in enhancing understanding of theoretical concepts and contributing to local communities. Further work is needed to better understand how South African geoinformatics students can be made aware of the role of geoinformatics in solving problems in society. (BEST PAPER AWARD OF THE SACLA'16 CONFERENCE)

- **Soft Skills may be Hard for Software Developers**
  V. Pieterse & M. van Eekelen (vpieterse@cs.up.ac.za)

This paper describes the employability skills that are essential for our students to succeed in a career in software development, and how we create opportunities for our students to develop these skills in our final-year software engineering module. We explain our techniques for observing where students fail to use these skills appropriately while working in their teams. Knowledge about these failures enables us to intervene and suggest remedial action. We conducted research aimed at understanding the students' problems when required to develop their social skills, especially when they have to cope with situations where members in their teams may lack social intelligence. We discuss how we intend to create better opportunities for our students to enhance their employability skills, based on the findings of our research.

- **Teaching Operating Systems: Just enough Abstraction**
  P. Machanick (p.machanick@ru.ac.za)
  There are two major approaches to teaching operating systems: conceptual and detailed. In this paper I explore the middle ground with an approach designed to equip students with the tools to explore detail later as the need arises, but without requiring the time and grasp of detail needed to understand a full operating systems implementation. My finding with designing a course to meet those goals is that various strategies apply to different concepts: faking the detail in some cases, and using techniques from computer architecture simulation in others. The overall result is a course where students have a better sense of how things work than a conceptual approach without as much time required as a full implementation-based course. Working out what "just enough abstraction" is remains a work in progress.

- **Towards a Generic DSL for Automated Marking Systems**
  F. Solms & V. Pieterse (vpieterse@cs.up.ac.za)
  Automated static and dynamic assessment of programs makes it practical to increase the learning opportunities of large student classes through regular assessment of programming assignments. Traditionally assessment are specified in tool-specific languages which are tightly coupled to the functionality and implementation of a particular tool. This paper considers current assessment specification languages and proposes a generic and extensible Domain Specific Language for the specification of programming assignment assessments.

- **Towards an Interdisciplinary Master Degree Programme in Data Science: A South African Perspective**
  J.H.P. Eloff & L. Marshall (lmarshall@cs.up.ac.za)
  Many businesses see Big Data and Data Science as a catalyst for innovation. The problem is that many of these businesses are hesitant to embrace these new technologies mainly because of a shortage in skilled manpower. On a global level, higher education institutions are in the process of developing curricula for postgraduate degree programs relating to Data Science. Developing such curricula have their own challenges. For example: What level of knowledge is required from disciplines such as Computer Science and Statistics? What underlying foundations in Mathematics are required? This paper presents a framework for

the design of an interdisciplinary Data Science curriculum on the postgraduate level.

CSERC'16: The 5th Computer Science Education Research Conference

- **A Workshop for Integrating UML Modelling and Agile Development in the Classroom**
  D. Stikkolorum & M. Chaudron (chaudron@chalmers.se)

  Students have various difficulties in software modelling, the software development process and positioning modelling as a means to support their software development. The Agile methodology SCRUM has gain popularity in industry and also amongst students. Unfortunately agile projects often lack of adequate documentation. The combination of modelling and agile development is not often used in education. Based on our positive experience with the interactive LEGO4SCRUM workshop we use in our programs, we propose an approach based on this workshop that integrates UML modelling into the SCRUM process. The workshop lets students experience a whole development cycle from a modelling perspective. Besides this new approach we also categorized comments students wrote down based on their discussions with their peers. We evaluated students with a questionnaire. The students react positive on the approach and indicate they gained new insights. This paper explains the workshop's set-up, presents its evaluation and discusses the results.

- **Career Goals of Software Development Professionals and Software Development Students**
  J. Liebenberg & V. Pieterse (vpieterse@cs.up.ac.za)

  In this paper we investigate differences in career goals within different populations with the aim to gain deeper understanding of the needs and views of the young generation that is currently entering the workforce. We focus on aspects of gender and age when comparing the two main groups in our study namely students and professionals. We explain our observations in terms of commonly accepted trends regarding generational differences and gender differences. Better insight in the career goals of the cohort that is currently the source of new recruits can support focused recruitment. The insight gained through this research can further support companies to retain their workforce by adhering to the identified expectations of their new recruits.

- **E-tutoring Support for Undergraduate Students Learning Computer Programming at the University of South Africa**
  V. Horner & P. Gouws (hornevz@unisa.ac.za)

  The focus of this paper is the experience of the lecturers and the e-tutors in implementing e-tutoring in the course "Visual Programming 1" at the University of South Africa. The topic of this paper is relevant because, presently there are few published studies on the topic

of e-tutoring implementations in developing country contexts. The study subjects were the lecturers, and e-tutors in the course. Quantitative and qualitative data was collected in order to assess improvements after implementation of e-tutoring in the course. The quantitative data was taken from the university's routine statistics directorate, while the qualitative data consisted of data collected from interviews of e-tutors. Firstly a reduction in the student dropout rate was observed after implementation of e-tutoring. The second finding is that leadership and motivation from the lecturers were key in implementation of e-tutoring. Thirdly, e-tutor interactions with the students must be guided by a tuition intervention that is directed at addressing the difficulties in the teaching of the course.

- **Evaluating Plagiarism Detection Software for Introductory Programming Assignments**
  P. Modiba & *V. Pieterse* & *B. Haskins* (vpieterse@cs.up.ac.za)
  Plagiarism is an issue that all educators have had to deal with. The large number of students and assignments have resulted in the development of automated systems to detect code similarities with the aim of identifying cases that may have been plagiarised. These systems are very advantageous to assessors, allowing them to process submissions automatically. However, these automated systems do present possible disadvantages and drawbacks. In this study we explore and analyse the differences between various systems as well as how their performance compares with manual checking. We consider the different methods students use when committing plagiarism. We then take a closer look at systems that can aid plagiarism detection from the characteristics they have to how they work. In the process, we determine the suitability of these systems to aid the identification of submissions that may have been plagiarised in our introductory C++ course.

- **Listening to the Affected: Student Views after Starting a 4th-Year Module in Data Warehousing**
  R. Goede (roelien.goede@nwu.ac.za)
  The development of a successful module in data warehousing for 4th year IT students requires involvement of various stakeholders. Critical systems thinking and especially critical systems heuristics promote the involvement of those affected by an intervention, in the design of the intervention. In the development of a data warehousing module the students who selected the module as part of their 4th year programme are viewed as 'affected' by the design of the module. This paper reports from a critical systems heuristics point of view on the perspectives of students who selected the module. Critical systems heuristics differs from other critical systems methodologies in terms of the requirements of rational argumentation. This paper provides examples of polemical argumentation and how these non-rational arguments are the voices we as faculty members (designers) should hear. The paper concludes with aspects to take into consideration for the development and instruction of data warehousing based on the views of students after they have selected the module.