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ATTEMPTS TO EMBED GREEN VALUES IN THE INFORMATION SYSTEMS CURRICULUM: A CASE STUDY IN A SOUTH AFRICAN SETTING

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Abstract

Environmental Sustainability is a persisting problem and it is incumbent on educators in Higher Education to address this urgent need. In the spirit of creating awareness of this real life problem and to adequately prepare students for professional practice, an attempt was made to embed content about environmental sustainability into the Information Systems (IS) curriculum at the University of Cape Town. This paper reports on a case study where five teams of undergraduate students were tasked with examining power consumption and paper wastage on campus and conducting experiments aimed at reducing consumption. The theoretical framework of Green Information Systems developed by Ijab which draws on the IS lifecycle framework proposed by Diez and McIntosh was implemented in this study. The most important contributing factors for success of the student experiments were found to be communication, a phased approach and the application of De Bono’s concept of serious creativity. The study further demonstrated that awareness of environmental sustainability was increased through a process of guided reflection during project execution. A key observation, worthy of future research, was the experience by the students of resistance to change by participants, who reverted to environmentally-unfriendly practices on conclusion of the experiments.

Key words: Curriculum, Environmental Sustainability, Higher Education, Green Information Systems
1 Introduction

1.1 Context for adding sustainability to the curriculum

It is the role of educators to give students practical challenges in the curriculum which will adequately prepare them for their roles as professional practitioners. “In merging theory and practice we will end up with better theory, better practice and better learning that will prepare us for both practice and learning” (Raelin, 2007, p. 495). It may be argued that the fact that the planet is in imminent peril (Hansen, 2011) is a relevant and challenging problem, and one of the greatest challenges of our time (Giddens, 2009). Environmental issues such as climate change have also created a range of wicked problems which are often ill-defined, unstructured and provide challenges for which no clear solutions are apparent (Chaplin et al., 2008).

The issue of environmental sustainability is also a persistent one, despite the fact that it has received attention on the global agenda for more than 20 years (Brundtland, 1987). The authors of this paper will argue that embedding this relevant and persisting problem into the IS curriculum is practically and conceptually important. The IS domain is uniquely well suited in helping to find workable solutions for sustainability for the following reasons. Firstly, IS is inter-disciplinary, which enables it to cut across boundaries and deal with the ubiquitous nature of sustainability. Roode (1993, p. 62) refers to Information Systems as “an inter-disciplinary field of scholarly inquiry, where information, information systems and the integration thereof with the organisations is studied in order to benefit the total system (technology, people, organisations and society)”. Secondly, IS tends to be holistic as, by definition, it embraces a systems view (Checkland and Holwell, 1998). Thirdly, IS embraces not only technological and organisational systems, but is also interested in the problems and solutions (phenomena) which emerge when the two interact. (Lee, 2000). A fourth leg to the argument of why it is important to embed sustainability into IS is because environmental challenges may be seen as “wicked” problems with no easy answers, and effective crisis management of environmental changes will require effective management of IS (Winn, Kirchgeorg, Griffiths, Linnenluecke and Günther, 2011).

The idea of embedding such a problem in the curriculum also has pedagogical support, for example it is argued that the complex interaction of three bodies of knowledge (content, pedagogy and technology) has led to calls for a greater emphasis to be placed on the idea of teachers as curriculum designers (Koehler and Mishra, 2008).

This paper is set out as follows: we begin by examining the background context of the development, use and effects of IS on environmental sustainability objectives (Green IS) as well as the challenges and opportunities surrounding its implementation in Higher Education. The theoretical framework used is the Green IS typology (Ijab, Molla, Kassahun and Teoh, 2010) which explores the design, implementation and impact of IS on environmental sustainability.

We then present a case study which involves embedding Green IS into the curriculum of third year Computer Science students studying Information Systems. The paper examines some of the practical findings of the team projects of the students and examines their reflections of the experience, using the concept mapping tool, Leximancer. The findings are discussed as well as the contribution of the research. Because of the importance and urgency of the need for environmental sustainability, practitioners in Higher Education are urged to take up the opportunity to engage with this topic through curriculum redesign.

1.2 Green IS

The research area of Green IS is nascent as both academics and practitioners look for innovative ways of using systems to help achieve environmental sustainability objectives (Melville, 2010). As mentioned above, the challenge of eco-sustainability is a persistent and relevant one, which was raised
by the United Nations more than two decades ago (Brundtland, 1987). The subsequent international failure to develop and implement systemic solutions, in spite of growing awareness that environmental issues are amongst the most pressing of our time, has been described as a paradox (Giddens, 2009).

Both the business world and academia are fully aware of the threats to our planet. Research shows that this issue is high on corporate agendas: in the United States, 60% of firms surveyed planned to increase their sustainability investment in 2011 (MIT, 2011). The high priority afforded to this topic by institutions of Higher Education is borne out by the development of numerous declarations and charters which provides frameworks for sustainability at universities. Although Roorda (2000) notes that many charters are vague about the actions needed to reach sustainability objectives.

Some definitions of sustainability are relevant at this juncture. The concept of sustainable development has been described as the “ability to make development sustainable – to ensure that it meets the needs of the present generation without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). This notion led to the concept of the triple bottom line, encouraging a focus on environmental as well as social and economic objectives (Elkington, 1997). This view is supported by Hart (1997, p.67) who regards a sustainable global economy as “an economy that the planet is capable of supporting indefinitely”.

Definitions of Green IS are still in the process of being formulated in the research literature. We used the lens developed by Ijab et al. as it enabled students to conceptualise their understanding using a lifecycle framework. A system which is explicitly designed to support environmental sustainability objectives, may be described as a Green IS. The Green characteristics of these systems are embedded during the design and implementation phases of development and have impacts which are measurable (Ijab et al., 2010). This theoretical framework develops a perspective of IS from technical, human and process viewpoints and proposes a lens for observing the degree of environmental sustainability of a system via three elements – at the design stage, through usage and ultimately through measurable impacts. It is warranted through the lifecycle framework proposed for IS by previous researchers in this domain (Diez and McIntosh, 2009) who found factors such as external pressure, user participation, user perceptions, top management support and the availability of external information sources were some of the relevant factors of IS usefulness.

As environmental sustainability is an issue which is ubiquitous and cuts across many disciplines, it was our view that the curriculum of an inter-disciplinary domain such as IS could prove useful as a site of study. One reason for this is that IS has its roots in two paradigms, since it evolved from the social (behavioural) sciences as well as design science (Hevner, March, and Park, 2004). The behavioural science characteristic of IS allows us to explain and predict human and organisational phenomena, while the design sciences allow for problem solving. This dual nature of IS places its curriculum in a unique position to examine phenomena across boundaries.

Another argument is that a systems view, which is at the heart of IS, looks at the world as a complex web of relationships. Such a holistic viewpoint is more likely to yield a deeper understanding of the universe than the fractured, reductionist approach which has been the dominant paradigm since the 16th century (Capra, 1982). A purely technical approach to environmental sustainability often fails to take into account the interrelationship of problems and proposed solutions, which is incorporated in the systems view (Orlikowski and Iacono, 2001). The notion that a techno-centric approach may be part of the problem is a rich source of academic enquiry. Uncovering issues related to the integration of information technology within organisational cultures, as opposed to an exclusively technological focus, has proved to be a useful area of research (Ngwenyama and Nielsen, 2003).

In spite of a range of other disciplines focusing on the topic of environmental sustainability, few studies of environmental sustainability incorporate the information systems perspective. The locus of
IS scholarship spanning individuals, groups, organisations, markets, communities and design is congruent with the search for complex sustainability solutions involving both micro and macro perspectives (Melville, 2010).

It may be appropriate, then, for institutions of Higher Education to explore not only how to minimise negative environmental footprints, but also to consider including Green IS as part of the curriculum. An environmentally-aware curriculum enables students to become involved in real-world projects, acting as prototypes for Green IS in the wider community. Such an involvement serves a dual purpose in terms of developing the crucial skill set of students (Hagan, 2004) whilst at the same time educating them to become responsible citizens equipped to face real-world problems (Beard, Schwieger, and Surendran, 2007).

Mendoza and Ellis (2003) argue that the incorporation of a real-world project as a teaching and learning strategy allows students to develop the required mix of technical and managerial skills needed to face the challenges of the business environment - of which environmental sustainability has become an integral part. Mendoza and Ellis (2003) state that project-based learning provides students with an opportunity to make real-world IT management decisions in a controlled manner. Students can become passionate about participating in well-managed and meaningful projects, and regard them as fun, despite the challenge they are confronted with. Not only do such projects allow students to work autonomously towards constructing their own learning, projects also involve them in problem-solving and other meaningful tasks with the further promise of generating realistic products (Procaccino, Verner, and Lorenzet, 2006; Thomas, Ratcliff, and Thomasson, 2004).

1.3 Overview of embedding sustainability in the curriculum

In line with the inter-disciplinary and diverse nature of the IS discipline (Baskerville and Myers, 2002) the IS 2010 Curriculum Guidelines (Topi et al., 2010) suggest that “graduates of Information Systems undergraduate degree programs need a wide variety of specific skills and knowledge as a foundation for the high-level IS capabilities”. High-level capabilities are not limited to a specific domain, but are “driven by organisational needs and [are] more abstract and stable than knowledge and skills” (Topi et al., 2010). The action plan of the international campus charter, the Tailoires Declaration further acknowledges the major role that universities need to play and urges educators to develop programs that will “educate for environmentally-responsible citizenship” (Talloires, 1990).

Several institutions of Higher Education have already paved a way towards attempting to incorporate sustainability in their university curricula in order to achieve the impacts described by Ijab et al. (2010). Such attempts have ranged from the establishment of separate schools for sustainable development teaching and research within university structures to incorporating sustainability issues in existing curricula (Lozano, 2011; Watson, Boudreau, and Chen, 2010).

A discussion by Thomas (2004) on sustainability issues in Australian universities highlights an attempt by the Royal Melbourne Institute of Technology to incorporate sustainability in the university curriculum. The project was intended to introduce environmental education, starting with waste minimisation, into four disciplinary courses. Their target was to create a guiding framework for the revision of specific curricula (Thomas, Kyle, and Alvarez, 1999). However, the initiative failed to meet most of its objectives due to underestimation of the complexity of such a project, as well as lack of resources and support across the institution.

A rather different approach was undertaken at Cardiff University. At Cardiff, each school within the university followed a separate approach to sustainability development, in most cases by adopting a specialized and reductionist view (Lozano, 2011). An analysis of 19 schools was conducted using the Sustainability Tool for Assessing University’s Curricula Holistically (STAUNCH). The findings showed that the individual contribution of schools to sustainability development (SD), which was a
factor of the breadth and the depth of SD curricula, varied from 0.67 to 3.36%; with the percentage of courses within schools that contributed to SD ranging from 3 to 80 percent. Some schools contained many courses that all contributed to only one aspect of SD; while only a few schools had a satisfactory coverage of various aspects of SD (Lozano and Peattie, 2011).

A case study, more closely related to the one discussed in this paper, was conducted at the University of Hull; this study aimed at integrating sustainable development in the Information and Computer Science curriculum (Gordon, 2009). In a project intended to improve students’ awareness of sustainable development, the department took the initiative of incorporating several sustainability issues within its curriculum. Areas addressed within their curriculum included sustainable consumption and production, climate change and energy, natural resource protection and environmental enhancement, and sustainable communities (Gordon, 2009).

2 Case Study

In order to test the theoretical framework for incorporation of Green values into Information Systems (Ijab et al. 2010), a case study approach was adopted. This interpretivist approach has been validated as a rich source of qualitative material (Walsham, 2006).

The case study at the University of Cape Town (UCT) was conducted as part of the requirements of the Information Technology (IT) Management course, which is a third year IS course taken by business stream Computer Science students. These students are required to do a team project as part of the course, but no actual systems development or implementation is required. In 2011 a Green IS theme was chosen for this project to align with the focus of the team projects of their peers in IS who were required to develop systems that would benefit communities or address other socially-relevant challenges, such as environmental sustainability issues.

The concept of environmental sustainability is not new on the UCT campus. Several Green initiatives have been launched on campus since the mid 1980s, when an unsuccessful waste management project was undertaken. In recent years, a number of successful implementations have been achieved, including the reduction of waste sent to landfill sites by 70% (Rippon, 2011).

In order to embed Green IS into the curriculum, students were challenged to create a business case and were evaluated on a range of process elements including system objectives, identification of areas of concern and opportunities, critical assumptions and constraints, project scope, feasibility assessment, potential risks and mitigation, product quality assurance, an implementation plan and recommendations to management.

The project also afforded Computer Science students a better understanding of the IS discipline. Gupta and Wachter (1998) argue that projects help students to appreciate the business-oriented and pragmatic view of the IS profession by familiarising them with professional practice and behaviour, as well as by improving their time management skills and developing and reinforcing their technical competence.

An important benefit is that students gained the experience of working in teams as well as in communicating with other stakeholders, and discovered the challenges that these activities entail. Key stakeholders for the project came from the customer relationship and service level management section within the Department of Information and Communication Technology Services (ICTS). A close relationship was maintained with designated members of this section throughout the lifecycle of the project. They kick-started the initiative with a presentation to the students that introduced them to the power management of PC’s on campus, and also provided them with useful tips on managing ICT projects in general. Once approval had been obtained from the university authorities for this study, the
students asked specific people in different departments and faculties to participate by providing both time and information during the process.

In line with the quest for innovation and the nurturing of an entrepreneurial spirit, the student teams were initially challenged to find a specific situation of concern that they wanted to address in the broader context of the project brief of Green IS. Table 1 shows the location of the different projects that were undertaken by each team, their findings and recommendations.

<table>
<thead>
<tr>
<th>Department</th>
<th>Focus</th>
<th>Key Findings</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty of Commerce</td>
<td>Monitoring usage and power consumption of PCs and air-conditioning in selected labs</td>
<td>All computers in the lab are powered on 24 hours a day 7 days a week regardless of whether they are being used or not.</td>
<td>Install power management settings for automatic powering down of computers.</td>
</tr>
<tr>
<td>Department of Architecture</td>
<td>Monitoring usage and power consumption of lab PCs</td>
<td>All computers in the lab are on 24/7. Computers in the labs are not set up to make use of any power management tool.</td>
<td>A power management tool should be installed to potentially reduce up to 45% of electricity consumed.</td>
</tr>
<tr>
<td>Faculty of Commerce</td>
<td>Monitoring paper wastage in selected areas</td>
<td>Printing consumers are unaware of the role they can play and the effect they have on the environment. There are no Green printing management policies.</td>
<td>Display 12-step guide around the printing facilities to educate staff and students about eco-friendly printing and set default printing settings to duplex.</td>
</tr>
<tr>
<td>Department of Computer Science</td>
<td>Monitoring usage and power consumption of PCs in an undergraduate lab</td>
<td>All computers in the lab are on 24/7. There is a pattern on the use of computers in the lab as some are frequently used and others are hardly ever used mostly due to their location in the lab.</td>
<td>Apply de-randomised selection of computers (lab managers allocate computers to students) and power management settings.</td>
</tr>
<tr>
<td>ICTS</td>
<td>Monitoring power consumption of staff PCs</td>
<td>Staff not well sensitised to Green IT hence are currently not conscious of the impact of their activities when utilising technology, specifically their PCs.</td>
<td>Enact policies to enforce staff to practice Green behaviours when utilising their PCs. Equip staff with power management tools, training and campaigns.</td>
</tr>
</tbody>
</table>

Table 1. Key findings and recommendations.

The project was divided into four phases (see Table 2). Two Masters students were appointed to act as project managers for the different teams. Several meetings with these project managers were conducted during the first two phases of the project to finalise the focus area and then to compile and complete a business case. Tight deadlines were adhered to when conducting interviews, completing questionnaires and executing the experiments in the different contexts. The assessment approach included a formal continuous assessment process over the different phases of the project, formative assessment including self-assessment and peer evaluation, and a final summative assessment component to determine the competency level of the student teams (Pellegrino, Chudowsky and Glaser, 2001; Shepard, 2000). Customised rubrics were developed to assess the different phases. Students were expected to enhance and improve their respective business cases after holding discussion sessions with their project managers. Project teams first developed the business case at a macro level to obtain a high level understanding before they drilled deeper and developed the business case at a meso level to answer more in-depth questions (Remenyi, 1999). The project concluded with
a final project presentation and the submission of a documentation pack comprising the business case, the interview and questionnaire process, and the experiment and implementation process. A panel of five examiners evaluated and scored this final presentation.

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Contents</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of the situation of concern</td>
<td>Brief description and introduction to focus area partners</td>
<td>1</td>
</tr>
<tr>
<td>Business case</td>
<td>Macro and meso levels</td>
<td>2</td>
</tr>
<tr>
<td>Interviews and questionnaires</td>
<td>Making appointments; questionnaire distribution; data collection; data processing; data analysis.</td>
<td>3</td>
</tr>
<tr>
<td>Experiments</td>
<td>Gathering information; setting up experiment; monitoring experiment; processing data; analysing findings and implications.</td>
<td>4</td>
</tr>
<tr>
<td>Formal project presentation and submission of all documentation (and Lessons Learnt)</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2. The phased approach incorporated into the curriculum.

To add a fun element to the course, a photo session was conducted and each student was given a specially designed t-shirt printed with the slogan: “Green IS …. Cool”, which they wore when they conducted the interviews, completed the questionnaires, or performed the experiment.

3 Discussion and findings

While all of the groups developed a “spirit of Greenness” (Ijab et al., 2010) during their experiments, the impacts achieved were not all of lasting value. One of the teams embarked on a paper saving initiative. They interviewed the departmental administrators of the Department of Management Studies, the Department of Information Systems, and the research unit in Economics, which make frequent use of printers both for administrative tasks and student handouts. Large volumes of paper were found to be used in the departments of Management Studies and Information Systems. Analysis of questionnaires revealed that printing is not well managed in these departments, as the statistical data obtained from the Commerce IT section did not correspond to the data obtained from departmental users. From the findings, it became evident that printing consumers are unaware of the impact of their practices and the effect they have on the environment.

The team suggested that departments should try to implement Green courses, where resources are made available to students only in a digital format to reduce the amount of paper used. Notices could also be posted at workstations to create awareness of optional printer settings that could be used to save paper and ink. Finally, the team developed a 12-step guide for reducing printing costs and minimizing environmental impact. The team concluded that Green printing is feasible, that it should be introduced in incremental steps, and that the effort required to educate staff is a worthwhile cause for which to strive. Recognising the large numbers of computers located in various computer labs across campus, Teams 1, 2 and 4 decided to investigate the magnitude of the problem of energy consumption/waste resulting from PC usage in student labs. Their investigation included monitoring labs and distributing questionnaires to students, so as to gain an understanding of lab usage and students’ awareness. The project teams also interviewed various lab owners and faculty administrators regarding the policies and procedures currently in place to monitor computer usage in labs.

Their investigation led to the realisation that the management of most computer labs could be significantly improved, and that there was an opportunity to implement alternative procedures that could potentially reduce energy consumption. Although all three teams were looking at a similar problem, they came up with varying solutions and recommendations.
Team 1, whose focus was the Commerce Faculty computer lab, proposed making proper use of the energy saving settings options provided by computer manufacturers to turn off (or put into Sleep mode) computers when not in use. They also recommended an awareness campaign that would educate students on the various power saving settings at the start of the academic year. Team 2, which focused on a computer lab in the Engineering Faculty, recommended the installation of two freeware software applications on all computers in the computer labs: Joulemeter and WinOFF. Joulemeter would be used to record energy consumed and energy saved by each computer, while WinOFF would be used to turn off computers (or put them into Sleep mode) during the times when PC availability was identified as less critical.

Team 4, which focused on a computer lab in the Science Faculty, recommended the use of two software applications: Joulemeter (like Team 2) and Verdiene Edison. The latter would enable environmentally conscious students to scale down the amount of energy used by their computers, with a corresponding negative impact on performance. In addition, Team 4 recommended what they called ‘Phased Computing’, which refers to grouping computers in a lab based on the frequency of their usage. The subsequent implementation of appropriate energy saving settings for each group of PCs would result in much more effective usage of the lab and the promise of creating significant power savings.

Team 5 kicked off their research by conducting interviews with the heads of different sections in ICTS, including the heads of Technical Support Services and Customer Services, and the Director of Systems. These interviews gave the students a clear understanding of the working structure of ICTS, and also increased their awareness of issues affecting ICT users in and around campus. Although the was not able to use the third party software application of their choice, the Windows application was sufficiently useful to demonstrate how effectively energy consumption can be reduced and power saved simply by activating a few workstation settings. The team then drafted and distributed step-by-step instructions to guide the ICTS staff in activating their Windows Power Management settings. Their interviews, questionnaires and experiments highlighted the fact that the concept of Green IS is not understood by many employees who use PCs, and the team believed that this case study gave them an opportunity to create awareness.

4 Lessons learned and reflections

In addressing the implementation and impact of Green IS, students were confronted by a mismatch between their own green values (Ijab et al., 2010) and the values that were revealed through the behaviour of stakeholders.

On reflection, students identified that a key issue relating to this mismatch of values centred on communication. The project created an acute awareness amongst the students that communication is never perfect (Cockburn, 2002), and that one should not be satisfied with only one hat (De Bono, 1995). The project not only helped individuals to know themselves, but also to better understand their team members and appreciate their talents. Despite the challenges they faced and the fact that they were often surprised by people’s unwillingness to change, several students commented in their final presentation that the “project was fun and perseverance was a key to success!”

Through the lived experience of a project, students soon become aware that the real world is far more complex than the ‘happy day’ scenarios often presented in textbooks. It is thus necessary to guide students to “deal with the complex realities of projects in conjunction with their own knowledge and experience” (Winter and Szczepanek, 2009). For this purpose, readings were used as theoretical lenses during the course to help students to reflect on and make sense of their experiences.

Gregor (2006) concurs that a theoretical lens helps the researcher to identify the issues and people that are important to investigate, thus helping him/her to make sense of phenomena. The teams agreed that
the on-going reflection throughout the project guided their maturation processes. In addition to this, each individual student was required to use a few of the theoretical lenses provided to reflect on his/her experiences in the final assessment of the course. One student commented that this essay made them, as students, “stop and stare, to look at what we achieved and what we are lacking and then how to ameliorate oneself”. These essays formed the raw data which were fed into the Leximancer software with a view to extrapolating the key concepts.

The analysis is represented in the concept map in Figure 1. What is apparent from the Leximancer analysis is that students perceived a range of challenges linked to their project implementations. For the purposes of this paper, we will focus on a few of the main concepts: communication, hat (a reference to De Bono’s (1995) Thinking Hats), phases and stages. At the core of any iterative project is the ability to manage the incompleteness of communication (Cockburn, 2002). This includes appreciating that perfect communication in the sense of social exchanges and interactions is impossible, and focusing on communicating to the level that is sufficient for the intended audience. By using concepts learned in the course such as the impact of parsing patterns, students were able to reflect on their attempt to manage or at least recognise the idea of communication incompleteness. This included acknowledging differences in past experiences of team members and the impact these might have on their communication. They also referred to the submission of mini-deliverables for feedback and their interactions with project managers in an attempt to improve communication within the team (intra-group), as well as with other stakeholders in their project.

![Figure 1. Leximancer concept map of lessons learned via Green IS implementations.](image)

On reflection, many students found the teamwork tool of the thinking hats to be an eye-opener (DeBono, 1995). The six hat thinking system involves the metaphor of team members wearing different colour hats to signify a key type of thinking (information - white, intuition/emotion - red, logical negative - black, logical positive - yellow, creativity - green, process control - blue).

One participant noted: “Most of the time we would end up having debates on which idea would be best. If we would have looked closely into the situation, it would have been apparent that each of us had chosen our ‘hats’ amongst the ‘6 thinking hats’ unknowingly and we were acting on those roles. I was trying to come up with a creative idea that would stick out of the rest and therefore I was the green hat wearer. As everyone had their own ideas based on the characteristics, it became evident that we wouldn’t come to a conclusion and as a result Shabir (blue hat), who was the group leader took matters into his hands and made the decision, obviously with some negative comments from other group members. At the end we agreed upon that as we were different individuals who would differ in our opinions and thus it should be acknowledged.”
As the students moved through the different phases of the project making use of the deliberate reflection opportunities and the theoretical lenses, they could gauge their own team’s development in terms of Tuckman’s (1965) team development sequence of forming, storming, norming and performing. Team members who had just come together to form a team would be in a forming stage. From here a team moves to a storming stage: a stage where one of the teams reported that “group members may struggle with one another’s idiosyncrasies” and test boundaries, challenging one another until the norming stage is reached where they accept one another’s roles and positions and start working constructively towards creating shared experiences. These shared experiences helped them to “establish a necessary rhythm and way of doing things that was working well with us”, thus performing better as a team. Most teams commented that when the performing stage was reached “less energy was used for relationship and more energy was spent on the actual work”, sharpening the focus on the task at hand.

Teams also realised how Cockburn’s (2002) stages of human behaviour (following, detaching and fluency) determined their level of expertise when performing a task, and helped them to recognise when more effort was necessary to transcend to the next level. One student commented that “as we progressed so did our understanding and learning”; another one said: “we were approaching the detached phase, as we had to apply various theory concepts in our own style”.

Many teams also supported Cockburn’s (2002) notion that software development can be compared to a game. The teams agreed that the project in all its phases from initiation to closure was similar to a game in which they all participated towards a common goal. They often found the first phases, where they were blindly following templates and methodologies, to be very taxing. However, regular brainstorming sessions during which they reflected on the work done, enabled the students to achieve detachment: “by always asking ourselves why we do something – by implementing second order learning (Argyris, 1991) we can truly grow and allow for personal development.” This comment clearly indicates that students realised that thinking about a project or situation is a crucial stage in their development. It is during this stage that concepts and perceptual parcels emerge, true understanding evolves, and a deep appreciation is created.

5 Conclusions

The reflexive approach used in this project enabled students to conceptualise the meaning of the spirit of an information system: “the human values embodied in the structural and functional properties and functional capabilities” (Ijab et al., 2010, p. 437). Students embraced the incorporation of Green IS into the curriculum and were able to convince a broad range of stakeholders to change their behaviours, for example by automatically powering-down computers. These changes were accompanied by significant savings. However, students reported that when the experiment was over, most stakeholders returned their settings to the previous default mode, effectively halting the accrual of sustainable savings. This signal of resistance to change calls for further exploration in future studies. The addition of Green IS into the curriculum appears to be a rich source of experimentation possibilities, using the campus as a living laboratory for conducting pilot projects related to sustainability. These could be extended in the future to carbon footprints, automated water usage, reduction of energy consumption on a large scale across campus, monitoring biodiversity loss, and other sustainability issues leading to potentially significant impacts (Ijab et al., 2010).

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