

From Teacher-Oriented to Student-Centred Learning: Developing an ICT-Supported Learning Approach at the Eduardo Mondlane University, Mozambique

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ABSTRACT

Eduardo Mondlane University (UEM) is in the process of modernising its teaching and learning approaches. As one of the pedagogical reform projects, student-centred learning (SCL) in combination with Web 2.0 tools was introduced as a pilot in the course ‘ICT in Environmental Education’ in the Faculty of Education. This study explored—using action research strategy—to what extent the new pedagogical approach contributed to students’ competency development. Twenty-nine students were involved in the course. Eight semi-structured interviews with students were combined with sixteen classroom observations to see how students used the Learning Management System (LMS) and Web 2.0 tools over eight weeks. Content analysis was used for interviews and information produced by students. The results showed that collaboratively e-learning supported the development of students’ information management and problem-solving skills and their use of metacognitive strategies for self-regulated learning. Information and Communication Technology (ICT)–supported, problem-based learning contributed to greater intrinsic motivation. However, not all students were ready to adopt an active role. At the start, they saw teaching as a one-way knowledge transfer. This article recommends that e-learning initiatives in Mozambique always go together with an ICT-based literacy course and training in 21st-century learning skills.

Keywords: Student-centred learning, generic competencies, Web 2.0 tools, e-learning.

INTRODUCTION

Information and Communication Technology (ICT) is changing the way people process, access and distribute information. Technological skills are among the key qualities employers seek (Moeller & Reitzes, 2011; Young & Chapman, 2010; Alzu’bi, 2018). Higher education institutions are adapting themselves to employer demands to deliver ‘technology-savvy’ students. These institutions incorporate ICT in their programs in order to prepare students for working life (Moeller & Reitzes, 2011). Hayes, Schuck, Segal, Dwyer, & McEwen (2001) described how ICT can also transform pedagogy. In terms of educational philosophy, ICT can facilitate a shift in students’ learning approach: from reproducing knowledge conveyed by others to constructing knowledge themselves. In terms of didactical approach, ICT implies a move from teacher-centred to student-centred learning (SCL). In terms of material, ICT shifts the focus onto global resources. In terms of activities, ICT helps students to perform complex tasks using multi-modal information. Those changes do not take place as separate phenomena; they are interwoven. Learning with technology assumes a participatory and self-regulatory approach, while SCL benefits from e-learning and Web 2.0 tools.

Eduardo Mondlane University (UEM) started a curricular reform programme around 2000 (Muianga et al., 2013). ICT and SCL were introduced to improve the quality of teaching and learning. At first, it was not easy. Evaluation of courses across faculties showed that direct instruction was still the dominant approach, despite the various attempts to introduce a constructivist learning model (Universidade Eduardo Mondlane, 2008). Teachers lacked knowledge about new pedagogical approaches and used technology ineffectively (Universidade Eduardo

Mondlane, 2008).

These findings urged UEM to speed up the reform process in almost all faculties. A second phase of curricular reform was launched (Cossa et al., 2012). Competency-based program design was emphasised to assure the highest quality of learning and a push was given to ICT as a tool for active and critical learning. Several faculties started Web-supported SCL pilots.

Besides the various positive experiences, there was also uncertainty about how students perceived the introduction of ICT and SCL. This doubt was not specific to UEM. Schweisfurth (2011, p. 430) pointed to a lack of research studies that focus on the voices of young learners in developing countries. In order to find out which obstacles hindered the adoption of a new way of teaching and learning, this study specifically aimed at exploring the perceptions of students. Given the prevalence of the situation, the Faculty of Education of UEM developed and started implementing a competencies-based curriculum supported by an SCL approach and ICT.

The aim of this study is to explore the effects of a student-centred learning approach combined with the use of Web 2.0 tools in order to develop generic student competencies in the course ‘ICT in Environmental Education’. Action research was adopted to deal with real problems, preferably within communities, with the aim of finding solutions and producing guidelines for best practices (Koshy, 2005). The outcomes of the pilot could be helpful to improve all programs offered at UEM.

The research questions of the study were:

- How does the adoption of SCL in the course ‘ICT in Environmental Education’ contribute to the development of generic competencies, as perceived by the students? H
- How do the use of Web 2.0 tools in the course ‘ICT in Environmental Education’ support the adoption of SCL, as perceived by the students? H

LITERATURE REVIEW

Student-centred learning

A variety of learning theories speak about SCL in terms of self-regulated learning, the nurturing of higher-level learning abilities, collaborative learning, intrinsic motivation and metacognitive skills, surface learning strategies and intrinsic goals, as well as deeper learning strategies (e.g., Biggs, 1993; Marton & Säljö, 1976a; Laurillard, 2005). Felder and Brent (1996, p. 43) defined SCL as a broad approach that includes active learning experiences, self-paced and cooperative style, responsiveness to individual needs and the arousal of learning potential. The authors underlined the importance of giving students responsibility for their own learning and for engaging them in activities, such as peer discussions, writing of essays and exploration of each other’s attitudes and values. Commonly used terms for SCL are ‘active’ and ‘collaborative’ learning, emphasising students’ involvement in the learning process (Froyd & Simpson, 2008, p. 2).

The two dominant research traditions on SCL have focused on students’ approaches to learning (SAL) and self-regulated learning (SRL) (Biggs, 1987; Lonka, Olkinuora, & Mäkinen, 2004; Apiola & Tedre, 2013). Researchers focusing on SRL have highlighted, for instance, deep learning, as it emphasises learners’ autonomy. Students are encouraged to control and direct their actions to achieve learning goals like information acquisition and self-guidance of professional growth (Marton & Säljö, 1976b; Zimmerman, 2000). Many scholars point out that the main pillars of self-regulated learning are involvement of students in learning activities, responsibility to motivate oneself and attainment of personal goals (Zimmerman, 2000; Greene & Azevedo, 2007).

In SCL, the lecturer takes the role of facilitator, not just a presenter of information (Motschnig-Pitrik & Holzinger, 2002). This role is crucial for guiding students to become producers, instead of consumers, of knowledge. SCL is not exclusively focused on personal and cognitive growth; it also focuses on the development of competencies needed to perform as a professional in a future job or in self-employment.

Studies carried out in developing countries have shown SCL to have various advantages over traditional teaching methods. First, SCL supports students with diverse learning needs and increases students’ retention of knowledge and skills. Second, SCL increases students’ motivation and self-confidence by including them in the decision-making process (Baeten, Struyven, & Dochy, 2013; Thanh, 2010). Third, SCL stimulates creativity

through emotional and intellectual discovery learning, which encourages students to become lifelong learners (Motschnig-Pitrik & Holzinger, 2002). Fourth, group work requires debate, brainstorming and negotiation, and this in turn gives students the opportunity to develop their communication and teamwork skills. Fifth, increased responsibility for one's own learning encourages students to become independent learners (O'Neill & McMahon, 2005).

The introduction of SCL into developing countries also faces challenges. Limited resources and large classes impede its implementation (O'Neill & McMahon, 2005; Schweisfurth, 2011). In the beginning, it is hard for teachers and learners to assume new roles as they must unlearn previous approaches (O'Neill & McMahon, 2005; Thanh, 2010). The shortage of staff trained in SCL is another problem (Tedre, Apiola, & Cronjé, 2011; Schweisfurth, 2011). Initial training in new pedagogy is therefore indispensable (O'Neill & McMahon, 2005).

UEM (2008) recognises that SCL is not a panacea for all problems. Not all students are involved, as independent, self-regulated learning might not suit everybody (UEM, 2008). Nevertheless, SCL offers opportunities for students to experience authentic learning as a basis to develop competencies that modern society requires of university graduates.

Generic competencies

In the world of work, a change is taking place from a qualifications-based working environment concentrating on jobs, to a competency-based environment focusing on the individual. Beyond the specific competencies related to a profession, people need generic competencies and skills that can be used to meet the needs of a modern society which is becoming more dynamic and complex and therefore demands professionals that are flexible enough to respond to new situations and problems (Rumsy, 1997; Kouwenhoven, 2003). According to Young and Chapman (2010), the term 'generic competency' is used to refer to competencies that can be applied across different job and life contexts. Males (2010) define generic competency as attributes or skills that are important to graduates across all disciplines. It is not easy to define this concept because some scholars use related terms such as 'generic attributes', 'generic skills' and 'employment skills' (Billing, 2003). In this study, the term generic competencies is used to refer all knowledge, skills, attitudes and attributes that can be utilised in new professional situations, in life today, as well as within and outside a profession (Kouwenhoven, 2003).

Web 2.0 tools and its integration in teaching and learning

In recent years, the use of Web 2.0 tools for education has been increasing. This is due to the fact that these tools are easily accessible to young people, expand communication, and promote information-sharing, interoperability and collaboration. The Web 2.0 tools are based on an open-access and open-source spirit, and they have accelerated the emergence of Web-based communities and new applications, like apps for social networking (Zeininger, 2009).

Although there are numerous definitions of 'Web 2.0 tools', for this study, we adopted Butler's (2012) definition: 'a wide array of Web-based applications which allow users to collaboratively build content and communicate with others across the world' (p. 139). This definition explains the purpose of this study, which is to allow students to collaboratively build content and communicate with others, and develop competencies like critical thinking, problem solving, communication, collaboration, media literacy, and information literacy. Some of the most commonly used Web 2.0 tools include blogs, wikis, Movie Maker, podcasts, Google Drive, social bookmarking, and social networking sites.

The use of Web 2.0 tools allows active participation, creation and sharing of digital and Web-based artefacts by groups and individuals, or by students and lecturers, thus leading to a change of attitudes related to the use of the Internet. According to McLoughlin and Lee (2010), the use of Web 2.0 tools for teaching and learning has great advantages because it seems to tap into the increase of the multifaceted capabilities of interaction and communication.

Web 2.0 tools can offer possibilities for improving the teaching and learning process when they are well integrated, encouraging the practice of information searching through the Internet, development of communication and language skills, and, fundamentally, promotion of cooperation and collaboration skills, as well as knowledge sharing (Coutinho & Bettentuit, 2007; Stubbé & Theunissen, 2008). Using Web 2.0 tools, students are free to express ideas and engage in reflective processes on an individual basis, combining both independent work and peer feedback, thus ensuring independent learning and collaborative interaction (Lui, Choy, Cheung & Li, 2006).

METHODOLOGY

The interventions in this study targeted two elements of the curricular reform programme: the professional

development of students and the modernisation of the teaching and learning approaches across the university.

Action research consists of self-reflective stages, which are fluid, open and responsive (Koshy, 2005). The first stage has to do with identification of the change pursued. This was done through context analysis: How can SCL contribute to the improvement of the university's courses? Researchers explored the current teaching and learning practices and the existing pedagogical vision. They pinpointed what could be improved through adoption of SCL. Next, the researchers developed the research questions and planned the research. It was decided to integrate SCL and ICT in a regular course. A formative evaluation scheme was designed with the intention to use the results to improve the SCL approach (third stage). SCL strategies based on Web 2.0 tools and learning activities were (re-)designed with the intention to promote generic competencies. Implementation of SCL and learning activities was stage four. The final stage was a summative evaluation of all steps. At each stage, researchers (experts) and students (learners) were involved.

In this study, the cycle of self-reflective action research stages was carried out once. However, the results of this research directly feed the future actions needed to improve the educational practice of the university.

Data collection and analysis

Data were collected through semi-structured interviews and observations by researchers having strong experience in ICT for education. The observations were used to collect data to verify whether the content was suitable for the class's learning needs and whether the proposed activities improved the student learning process. This technique was also used to monitor the appropriateness of resources used with the content. Observations were performed in the classroom, in the LMS and across Web 2.0 websites produced by students.

The interview and observations guidelines were developed following the suggestions from the literature by following the stages of preparation, construction of effective research questions and implementation of the interviews (Amado, 2000; Creswell, 2007; Koshy, 2005; Wragg, 2013). To validate both interview and observation guidelines, senior experts in the field of educational research methodology revised and even removed or adapted some questions or items to fit the objectives and to answer the research questions of this study.

For content analysis, we considered three phases. The first phase consisted of transcription of the interviews respecting completeness, representativeness, homogeneity, relevance and exclusivity. In the second phase, we chose the coding units, adopting the procedures of codification (semantic classification) and categorisation. In the third phase, we interpreted the information from the previous phases, making them meaningful and valid (Bardin, 2011; Wragg, 2013). For the content analysis phase, a research expert gave feedback on the results.

During the process of interviewing students, the focus was to understand whether and how Web 2.0 tools improved their competencies. During the eight-week course, an interview was conducted every two weeks with two students chosen randomly. Students' activities in their assignments were analysed using Creswell's (2007) data analysis spiral. Additionally, the interviews were also transcribed, coded, analysed, reflected upon and categorised in a circular process. Interviews were held in Portuguese and translated into English by the researchers.

Course organisation

Like other courses that are used as pilot on using the SCL approach, the course 'ICT in Environmental Education' was run for first-year undergraduate students in the Faculty of Education. The aim was to provide students with knowledge and skills about the use of Web 2.0 tools and an LMS for environmental education. With these tools, the students were expected to explore the content in a more creative and critical way, thus developing relevant generic competencies.

Until the start of the pilot, teaching was done in the traditional way: relying on transmission of knowledge, memorising theory that had no link to real-life problems and accumulating information through lectures. The teacher selected the content and materials, and evaluation was a reproduction of what was transmitted.

In the pilot, the lecturer changed roles from deliverer of knowledge to facilitator of learning in small groups at students' own pace. The lecturer helped students to develop skills, allowing them to construct their own knowledge and their own learning strategies. The lecturer also got involved more in organising the course activities and monitoring student's interactions in the LMS.

Twenty-nine students, divided into eight groups of three to four students, participated in the eight-week course.

The class met face-to-face twice per week, for three hours each, for theoretical and practical guidance. Independent work using the LMS, in groups or individually, took 18 hours per week. Besides ICT skills, the students were expected to develop generic competencies: communication and collaboration; information research and information production; cooperation and self-learning; media literacy and information literacy; critical thinking and problem solving.

At the start, students were trained to use the LMS. Each group worked for two weeks with one of the Web 2.0 tools: wikis; podcasts; or video sharing, social bookmarking or social networking sites (blogs, Facebook or Twitter). Each group wrote a blog entry with the chosen tool and presented it during a classroom meeting. For this task, students created multimedia content using a mobile phone, digital camera or Movie Maker. One computer lab assistant and two information technology (IT) technicians were available to help. Students discovered how to use different IT tools, and they taught others about it. Most discussions took place in the LMS.

In the first face-to-face session, students were introduced to Web 2.0 tools: they created Facebook accounts and connected their profiles. Then they were divided into groups. Each group chose a realistic environmental issue to study, produced videos and pictures, uploaded them to their blog and discussed their findings. Next, they decided how they could raise awareness among citizens about that particular issue. Some examples of the problems chosen were littering, erosion, increase of waste in poor neighbourhoods, and inappropriate use of drains.

During the following three-hour sessions, students analysed and evaluated the work of two other groups. For evaluation, a pre-defined rubric was used to generate questions and debates in the LMS discussion forum. The various assignments that were carried out were used to assess the course. Group work carried 50% weight in the final evaluation. The other 50% was divided between active participation in the classroom and the discussion forum, sharing resources, Internet search results, and evaluation of each other's work.

FINDINGS

Adoption of SCL and competency development

There was a shared feeling among students about the valuable contribution of group collaboration to their competency development. Their perception concerning the use of modern pedagogical practices had changed. One of the male students, 'I' (a pseudonym), described the changes in his mindset:

I__[male] 'At the beginning of this course, I could not take hold on the problems of my colleagues ... nor formulate a constructive judgment ... but now I understand how to help my colleagues ... and improve my own work after seeing the work of my colleagues.'

The above excerpt exemplifies that collaboration enabled students to take an active role in knowledge sharing. The decision-making processes in groups stimulated students to explore the views expressed by others. Analysis of blogs showed improvement of information management skills. Students collaborated to find information on the Internet about environmental problems, and they discussed their findings in order to come up with solutions. Working in groups requires interpersonal and communication skills, which are important professional characteristics in today's workplace (Young & Chapman, 2010). The following quote shows a combination of collaborative learning with ICT tools:

M__[female] 'We managed to select an environmental problem and uploaded pictures to illustrate it We also produced text to explain the pictures. This helped to discuss our topic with other groups We also managed to produce a video that showed our thinking.'

Since all the assignments were accessible online, students could comment and evaluate each other's work without the lecturer's interference. These activities contributed to critical and constructive thinking. M reported: 'This course and Web 2.0 tools helped us to reflect on our work and gave us a different vision on how to evaluate our own work and the work of our colleagues.' Constructive evaluation is essential for the development of critical thinking (Froyd & Simpson, 2008). Observation showed metacognitive development by students' learning from assessing their work with a rubric and by comparing their solutions with those of others.

ICT to facilitate adoption of SCL

The use of technology together with realistic and self-selected tasks increased students' intrinsic motivation, as in previous studies (Motschnig-Pitrik & Holzinger, 2002). R [female] commented: 'Real-world problems made me study the tasks more intensively, so I understood the topic better.' Students searched the Internet for relevant information, which enabled them to deepen their knowledge and to propose suitable solutions to environmental

problems. Reflection took place at each step of the learning process: orientation, problem analysis, and presenting conclusions. The method of learning in the course was a turning point for many students. They perceived the positive effects of collaborative and self-regulated learning as well as the advantages of modern ICT tools, all elements long campaigned for by the university.

Another positive effect was the increase in computer literacy. Students did not have smartphones or Internet connections at home and did not have email accounts or social networking accounts at the beginning of the course. During the course, all students learned how to create multimedia content with Web 2.0 tools and how to upload the content to various websites. The results confirmed Motschnig-Pitrik and Holzinger's (2002) argument that Internet technology is well suited for SCL as it enhances independent learning and problem-solving skills. Yet students had different perceptions of why and how technology was of value. Some appreciated tool-specific skills: 'I learned to edit videos and animate images with Moviemaker ... and also to use a blog' (P [male]). Others emphasised the value of new tools for sharing knowledge: 'Now I can use a blog and share information about environmental conservation' (R [female]). Others mentioned growth of meta-knowledge: 'Now I understand why ICT is important I learned to select relevant information.... I also know how to learn without a teacher I can find solutions This is good when I have a job' (V [male]). Another student said: 'Multimedia is a strong tool for environmental education because you can illustrate what is wrong and what is good ... and people learn faster.' Students' media literacy was developed, and they learned how to use Web 2.0 tools to produce digital content in different formats (videos, pictures and text).

The quality of group work improved throughout the course. All students learned to create and use blogs, and some students started to use Facebook and other social media instruments. They were able to discuss their cooperation and the final results.

Challenges found with the SCL approach

Observation showed differences between students' activity in the discussion forum. In the interviews, some of the less active students said that they lacked necessary basic ICT skills, while others disliked the new learning approach. Therefore, some additional explanation in the classroom meetings was needed on the use of the tools and on the participation that was expected.

Some students had difficulties adapting themselves to the new role of being an active learner that came along with SCL. According to Felder and Brent (1996), some resistance is to be anticipated when introducing SCL since its benefits are neither immediate nor automatic. In this study, SCL was introduced in a formal setting, which was new to most students. Therefore, the shift to ICT-based interaction and SRL raised problems. For example, some students waited until the time of the classroom meetings to ask questions, and others expected their lecturers to give direct help instead of using the course materials, rubrics or other self-guidance material. Those difficulties indicate a lack of confidence of learners in their own capacities, as P [male] explained: 'Most things were new I wasn't sure whether my group was doing the right thing Sometimes it wasn't easy to understand what the lecturers wanted from us.' Another challenge was how to comment on each other's work. Some students did not quite master the art of giving constructive feedback, which led to clashes.

Blog content and interviews showed that not all groups were successful in producing appropriate content for their selected problem. N [female] pointed out: 'In the presentation of your problem, your group spoke about the poor garbage collection by the city council, but the video that you uploaded reported health problems that arose from bad drainage maintenance. Although there is some relation between the two problems, they are not the same.'

DISCUSSION AND CONCLUSIONS

The interviews and assignments confirmed that students developed the generic competencies that this course was supposed to enhance: problem solving, collaboration, e-learning skills, information production on Web 2.0 and information search on the Internet. Mastering those skills is an absolute requirement for career readiness in the 21st century (Moeller & Reitzes, 2011).

Web 2.0 tools and the LMS supported the adoption of SCL. Similarly, SCL facilitated the technology-enhanced learning practices. The combination of e-learning and SCL worked well, even in this tradition-bound educational context. The Web 2.0 tools enhanced students' learning activities by stimulating them to write, collaborate, research, analyse, compare, debate, classify and publish what they had learned. Students searched for relevant information using the Internet and presented the information in appropriate formats. Even though the quality of the blog content varied between the groups, the results displayed students' growing ability to plan, organise and produce multimedia content. This was in line with the course objective: to develop information management

skills. The results of the pilot study confirmed other studies that also concluded that a combination of SCL and Web 2.0 tools enables students to explore information that is relevant to perform tasks at hand (Motschnig-Pitrik & Holzinger, 2002).

Most students did not feel too great a distance from the new practices, as they found that technology was of positive value for their construction of knowledge, even though some of them struggled to learn independently how to use these tools. The majority of students perceived the organisation of the course as exciting, which increased their intrinsic motivation. Several research studies confirm that SCL combined with modern technology is an enjoyable way to learn (Froyd & Simpson, 2008; Moeller & Reitzes, 2011; Motschnig-Pitrik & Holzinger, 2002; O'Neill & McMahon, 2005).

In terms of collaborative learning, group assignments encouraged communication, interpersonal skills, and knowledge sharing. However, students' level of engagement in group work varied. Previous studies showed that students without proper skills training work less effectively in groups (Brush & Soye, 2000). Hence, it would be incorrect to assume that every individual student benefitted equally from the group assignments. Also, individual performance was assessed by looking at active participation in the classroom and in the discussion forum, and by sharing materials and important resources.

In terms of competency development, the possibility to choose a real-life environmental problem as an assignment was motivating. Students showed that they could use available technology to find information, discuss problems and present a solution. Efficient use of technology promoted critical thinking and problem-solving skills. Evaluating group work, giving constructive feedback, commenting on group presentations and reflecting on how the learning process went all contributed to the gradual development of higher-order learning skills.

The implementation of SCL also faced several challenges. Not all students embraced SCL. This would hamper a wide-scale implementation of curriculum reform, as has been pointed out by several researchers (e.g., Schweisfurth, 2011). Furthermore, not all students adopted the available technology. They were not used to structuring their own work and assuming the role of an active learner. Students needed a lot of guidance and extra face-to-face meetings, as they had little experience in how to handle open-ended and (semi-)realistic assignments. This was an expected challenge, as it would be not very realistic to assume that students would perform perfectly on their first encounter with SCL. However, the adoption of SCL in a traditional learning environment could be improved by first giving a few smaller assignments as a way to carry out learning activities without direct instruction by the teacher. By practicing, students can slowly adapt to SCL (Froyd & Simpson, 2008; Brush & Soye, 2000).

The main reason for students' inability to use new technology was the traditional teaching and learning culture they were familiar with. This challenge has been pointed out in many previous studies and was expected to show up in this study as well (O'Neill & McMahon, 2005; Schweisfurth, 2011; Thanh, 2010). The buy-in time for SCL implementation varies and depends on the culturally appropriate distance between teachers and learners (Schweisfurth, 2011). In the case of Mozambique, students are used to receiving a lot of direct assistance from the lecturers, and they assumed that they would receive this during the pilot as well. When students had to work independently, they felt insecure and confused. Even though it is hard to change what is culturally appropriate, the pilot shows that with the necessary preparation and guidance, SCL can support the competency development of students.

The findings indicate that SCL and Web 2.0 applications have the potential to increase the quality of education in terms of equipping future graduates with necessary skills to perform as successful professionals in the 21st century labour market. The design of the pilot course and the lessons learned from this study are suitable to be adapted to other courses at UEM.

Because the results are promising, the university should continue to invest more in training lecturers in SCL. This new pedagogy is required to fulfil the requirements of the labour market to deliver competent students. By shifting to SCL—and using Web 2.0 tools—we believe that the quality of education at UEM will increase, especially in terms of a greater motivation, a better retention of knowledge, an increase in learning skills and a deeper understanding of the subjects taught (Froyd & Simpson, 2008). Lessons can be learned from the pilot study on how to realise a transformation of the direct teaching approach towards self-regulating learning. Guidance must enable students and teachers to leave behind the roles to which they are culturally accustomed. The curriculum must be restructured, and the assignments must be updated.

The findings presented in this paper about the improved learning results should be taken with some caution, as students had limited opportunities to practice their newly acquired skills. The solutions they presented for the environmental problems were theoretical. Hence, there is no assurance that the solutions will work in reality. Furthermore, the results of this study cannot be generalised to other populations outside this specific study. There is, however, no reason to believe the results would not be applicable, to some extent, to other similar contexts. The most important finding of this study was the successful test of a change in pedagogical approach and the development of ICT competencies that gave a push in the direction of SCL.

In further studies, it will be important to compare the learning outcomes before and after the introductions of pedagogical changes.

REFERENCE LIST

- Alzu'bi, M. A. M. (2018). The degree of applying e-learning in English departments at Al-Balqa Applied University from instructors' perspectives. *Turkish Online Journal of Educational Technology*, 17(1), 192–196.
- Amado, J. (2000). A Técnica da Análise de Conteúdo. *Referência. Revista de Educação e Formação em Enfermagem*, 5, 53-63.
- Apiola, M., & Tedre, M. (2013). Deepening learning through learning-by-inventing. *Journal of Information Technology Education*, 12, 185–202.
- Bardin, L. (2011). *Análise de conteúdo*. São Paulo: Edições 70.
- Baeten, M., Struyven, K., & Dochy, F. (2013). Student-centred teaching methods: Can they optimise students' approaches to learning in professional higher education? *Studies in Educational Evaluation*, 39(1), 14–22. doi:10.1016/j.stueduc.2012.11.001
- Biggs, J. (1993). What do inventories of students' learning processes really measure? A theoretical review and clarification. *British Journal of Educational Psychology*, 63(1), 3–19.
- Biggs, J. B. (1987). *Student approaches to learning and studying* [Monograph]. Hawthorn, Victoria, Australia: Australian Council for Educational Research Ltd. Retrieved from <https://files.eric.ed.gov/fulltext/ED308201.pdf>
- Billing, D. (2003). Generic Cognitive Abilities in Higher Education: An International Analysis of Skills Sought by Stakeholders. *Compare*, 33(3) : 335-350.
- Brush, T.; Soye, J. (2000). Implementation and evaluation of a student centered learning unit: A case study", *Journal Educational Technology Research and Development*, 48 (3), 79–100.
- Butler, J. W. (2012). Grappling with Change: Web 2.0 and Teacher Educators. In Polly, D., Persichitte, K. & Mims, C. (Eds). *Technology in Teacher Education: Key Issues*. Hershey, PA: IGI Global.
- Cossa, E. F. R., Tajú, G. A., Tembe, C. C. A., Domingos, L. N. C., Muianga, X., Rosário, L. S. C., Zimba, H. F., & Mambo, A. 2012. *Reflexão sobre a formação psicopedagógica dos professores do Ensino Superior*. Maputo: Universidade Eduardo Mondlane.
- Coutinho, C. P. & Bottentuit Júnior, J. B. (2007a). Blog e Wiki: Os Futuros Professores e as Ferramentas da Web 2.0. *SIIE*. 199-204.
- Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.
- Felder, R., & Brent, R. (1996). Navigating the bumpy road to student-centered instruction. *College Teaching*, 44(2), 43–47. doi:10.1080/87567555.1996.9933425
- Froyd, J., & Simpson, N. (2008, August). *Student-centered learning addressing faculty questions about student-centered learning*. Paper or poster session presented at the meeting of Course, Curriculum, and Laboratory Improvement, Washington DC. Retrieved at http://clicconference.org/files/2010/03/Froyd_Stu-CenteredLearning.pdf
- Greene, J. A., & Azevedo, R. (2007). A theoretical review of Winne and Hadwin's model of self-regulated learning: New perspectives and directions. *Review of educational research*, 77(3), 334-372.
- Hayes, D., Schuck, S., Segal, G., Dwyer, J., & McEwen, C. (2001). *Net gain? The integration of computer-based learning in six NSW government schools, 2000*. Retrieved at http://www.curriculumsupport.nsw.ed/learningtechnologies/files/Lea_netgain.pdf
- Koshy, V. (2005). *Action research for improving practice: A practical guide*. Thousand Oaks, CA: SAGE Publications.
- Kouwenhoven, W. (2003). *Designing for competence in Mozambique: towards a competence-based curriculum for the Faculty of Education of the Eduardo Mondlane University*, Doctoral dissertation, University of Twente. Enschede.
- Laurillard, D. (2005). Styles and approaches in problem-solving. In F. Marton, D. Hounsell, & N. Entwistle (Eds)., *The experience of learning: Implications for teaching and studying in higher education* (pp. 126–144). Edinburgh: University of Edinburgh, Centre for Teaching, Learning, and Assessment.

- Lui, A. K., Choy, S.-O., Cheung, Y. H. Y. & Li, S. C. (2006). A study on the perception of students towards educational weblogs. *Informatics in Education*, 5(2), 233-254.
- Lonka, K., Olkinuora, E., & Mäkinen, J. (2004). Aspects and prospects of measuring studying and learning in higher education. *Educational Psychology Review*, 16(4), 301–323.
- Males, S. A. (2010) Generic Engineering Competencies: A Review and Modelling Approach. *Education Research and Perspectives*, 37(1), 25-51.
- Marton, F., & Säljö, R. (1976a). On qualitative differences in learning: I—Outcome and process. *British Journal of Educational Psychology*, 46(1), 4–11.
- Marton, F., & Säljö, R. (1976b). On qualitative differences in learning: II—Outcome as a function of the learner’s conception of the task. *British Journal of Educational Psychology*, 46(2), 115–126.
- Moeller, B., & Reitzes, T. (2011). Integrating technology with student-centered learning. Quincy, MA: Nellie Mae Education Foundation.
- Motschnig-Pitrik, R., & Holzinger, A. (2002). Student-centred teaching meets new media: Concept and case study. *Educational Technology & Society*, 5(4), 160–172.
- Muianga, X., Hansson, H., Nilsson, A., Mondlane, A., Mutimucuo, I., & Guambe, A. (2013). ICT in education in Africa—Myth or reality: A case study of Mozambican higher education institutions [Special issue]. *African Journal of Information Systems*, 5(3).
- O’Neill, G., & McMahon, T. (2005). Student centred learning: What does it mean for students and lecturers? In *Emerging Issues in the Practice of University Learning and Teaching* (pp. 27–36). Dublin: AISHE Publications.
- Rumsey, D. (1997). The changing workplace of the 21st Century: Implications for educators and trainers. Paper presented at the Annual Conference of the Australian Association for Research in Education. Retrieved at <http://www.aare.edu.au/97pap/rumsd023.htm>
- Schweisfurth, M. (2011). Learner-centred education in developing country contexts: From solution to problem? *International Journal of Educational Development*, 31(5), 425–432. doi: 10.1016/j.ijedudev.2011.03.005
- Stubbé, H.E. and Theunissen, N.C.M. (2008) Self-Directed Adult Learning in a Ubiquitous Learning Environment: A Meta-Review. In: Kalz, M., Koper, R., Hornung-Prähauser, V. and Luckmann, M., (Eds.), *Proceedings of the First Workshop on Technology Support for Self-Organized Learners*, RWTH Aachen University, Aachen, 5-28.
- Tedre, M., Apiola, M., & Cronjé, J. C. (2011). Towards a systemic view of educational technology in developing regions. *AFRICON*, 2011, 1–8.
- Thanh, P. T. H. (2010). Implementing a student-centred learning approach at Vietnamese higher education institutions: Barriers under layers of Casual Layered Analysis (CLA). *Journal of Futures Studies*, 15(1), 21–38. Retrieved at <http://www.jfs.tku.edu.tw/15-1/A02.pdf>
- Universidade Eduardo Mondlane. (2008). *Plano estratégico: 2008-2012 [Strategic plan: 2008-2012]*. Retrieved from <http://www.plano.uem.mz/images/PDF/Plano/PE20081.pdf>
- Young, J., & Chapman, E. (2010). Generic competency frameworks: A brief historical overview. *Education Research and Perspectives*, 37(1), 1–24.
- Wragg, T. (2013). *An Introduction to Classroom Observation (Classic Edition)*. Routledge.
- Zeininger, C. (2009) – The Use of ICTs in HEIs in Mozambique: Institutional Websites as Ambassadors for Educational Technologies? WSIS Knowledge Communities. Retrieved at www.wsis-community.org.
- Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). San Diego: Academic Press.