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Teachers´ perspectives on professional development in the use of SCL approaches and ICT: A quantitative case study of Eduardo Mondlane University, Mozambique

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ABSTRACT

Eduardo Mondlane University (UEM) has carried out curricular reform since 2000 to introduce Student Centered Learning (SCL) as well as the use of Information and Communication Technology (ICT). To meet the demands of this reform, UEM has introduced professional development training for teachers. The Technological Pedagogical Content Knowledge (TPACK) model was used as a theoretical framework to design the training and to evaluate how, if at all, professional development training has changed pedagogical practice. This quantitative study has its focus on teachers who followed the training over a period of 3 years. 147 teachers returned a questionnaire, from which 92 who used SCL and ICT for teaching and learning purposes - were selected for this study. Results indicate that professional development has an impact on teachers' beliefs and practices. It supports the shift from traditional teacher-centered instruction to SCL. Teachers who attended the training are more likely to use ICT and SCL, having changed their perception of the impact of professional development on their day-to-day work and the lives of students. In addition, teachers who participated and used ICT believe that ICT contributes to changes in students' learning outcomes and the quality of educational processes.

Keywords: *Professional development, Teacher Training, Pedagogy, TPACK, Higher Education, Developing Country*

INTRODUCTION

In the last decade, Information and Communication Technology (ICT) has been at the core of a global transformation towards a knowledge-based society and has triggered important social changes in the way we live, work, collaborate and communicate (Huda et al., 2018; Mioduser, Nachmias and Forkosh-Baruch, 2008). Therefore, it is essential that the education sector prepares students for the changing nature of most jobs in the 21st century (Anderson, 2010). To meet this demand it is necessary to shift the focus from teaching to learning, where learning does not occur through facts or drill and practice but through creative and critical thinking, problem solving, planning, action and reflection (Majumdar, 2006).

The paradigm shift to Student Centered Learning (SCL) with its focus on the learner who is active and responsible for his/her learning and where knowledge is constructed rather than transferred, has been promoted as an alternative to the more traditional teacher-centered way of learning (Brush & Saye, 2000). In SCL the teacher's role changes from the owner of knowledge to a facilitator of learning, who looks at students not as individuals without any kind of knowledge but as learners to be guided along their intellectual development process (Wright, 2011). Crucial in facilitating this shift is the creation of learning opportunities that foster competencies which students need to function successfully in the world of work (Francis, Ngugi & Kinzi, 2017). Professional

development of teachers in Higher Education can be one of the catalyst factors leading to change in the traditional practices of teaching and learning (Hosman & Cvetanoska, 2013).

This study presents a case study, evaluating the professional development initiatives carried out at the University Eduardo Mondlane (UEM), to promote the use of ICT and the introduction of SCL, using the Technological Pedagogical Content Knowledge (TPACK) framework.

BACKGROUND OF THE STUDY

Context of implementing ICT and SCL at UEM

UEM recognized the value of ICT and SCL and started a curricular reform process in the early 2000s to enhance teaching and learning. In the Strategic Plan for Higher Education 2011-2020, one of the main objectives of this reform was to promote SCL as the key pedagogical approach to raising the quality of education and the relevance of the programs offered (MINED, 2011). The focus shifted increasingly to equipping graduates with 21st century competences needed to perform successfully in the modern workplace (Muianga et al., 2013). Despite considerable efforts to change the teaching and learning practices at UEM, research and curriculum documents showed that most of the teachers continued to use out-dated content and obsolete teaching methods (Cossa et al., 2012; Mendonça, 2014). Lesson observations made it clear that students were passive, acting as mere consumers and reproducers of knowledge transmitted by teachers. The documents also showed that ICT was still not used effectively as a tool for teaching and learning (Mendonça, 2014; MINED, 2011; Muianga et al., 2018).

The Centre for Psycho-Pedagogical Orientation, a support centre for UEM teachers, initiated the very first pedagogical training right after Mozambique gained independence in 1975 (Mandlate, 2003). At the beginning of 1980s, another initiative was launched, namely the creation of a teacher-training institute, called the University of Pedagogy (UP). This institute should provide pedagogical training to UEM's inexperienced teachers, as teachers who graduated in a certain discipline or professional field, were recruited for an academic career without prior pedagogical training (Mandlate 2003).

Not long after the introduction of the pedagogical training offered by the UP, it was noticed that the teachers did not take it seriously. They considered participation as an administrative obligation (Mandlate, 2003). To solve this problematic situation, UEM initiated a Staff Development Pilot Project (STADEP) in 1989 (Mandlate, 2003). With the revitalization in 2000 of UEM's Faculty of Education (which had been closed down after the opening of the University of Pedagogy), STADEP was integrated into the Faculty and it was renamed 'Centre for Academic Development (CAD)'. From that time onwards, the university has cooperated with international organizations to train teachers in new pedagogical approaches, to implement active and competence-based learning and to use ICT as a tool for learning. To understand the impact of these new professional development activities introduced by CAD, this study evaluates how, if at all, training has changed the teachers' pedagogical practices and their use of digital technology to facilitate SCL. The importance of studying the question of whether academics have learnt something relevant, valuable, and applicable from professional development activities has been pointed out by previous studies (Rienties et al., 2012; Stes et al., 2010). Those studies show that professional development of academics in Higher Education is often more motivated by institutional goals than by actual concerns that teachers have a weak focus on student learning (Rienties et al., 2012). Professional development activities do not always address in a meaningful and systematic way the need to develop ICT skills and competencies (Dlamini & Mbatha, 2018).

Given these issues this study addresses the following research questions:

How, if at all, did the professional development programs of CAD change the technological and pedagogical practice of teachers at UEM?

a. What is the impact of the professional development program on the teachers' adoption of digital technology to facilitate SCL?

b. What is the contribution of the professional development program to the teachers' adoption of digital technology to facilitate SCL aiming at enhancing students' learning outcomes?

Theoretical Framework

Previous studies on professional development, for instance those which refer to the concept of the learning organization, highlight personal mastery, team learning, mental models, shared vision and system thinking, highlighted these areas as the most relevant aspects to be enhanced. Development of those areas can help the organization to meet the demands and challenges that emerge due to rapid changes in modern society (Dekoulou, & Trivellas, 2015; M.M, Tahmir, & Nawawi, 2016).

A model that can be used for the design of a successful professional development program is the Technological Pedagogical Content Knowledge (TPACK) model. This conceptual model is widely used by educators and educational researchers to design and implement technology-enhanced learning (Kihoza at al., 2016; Koehler et al., 2014; Moroney & Haigh, 2011; Rienties et al., 2012).

To understand the TPACK model one must consider the complex interplay between technology, pedagogy, and content. As acknowledged by many scholars, ICT alone does not improve the quality of education. What is transformational is the knowledge of how ICT can be used to enhance the teaching and learning processes (Kihoza et al., 2016; Koehler & Mishra, 2005; Majumdar, 2006). Therefore, effective teaching requires that teachers have both subject matter and pedagogical knowledge and knowledge related to technology. Taking into account the possible combinations of the main areas, the TPACK model consists of seven knowledge areas. Three of the seven areas are core knowledge areas, namely content, pedagogy and technology (Koehler & Mishra, 2005). The seven areas are shown in Figure 1 below.

TPACK was developed by Mishra & Koehler (2006) and is based on Shulman's (1986) model of Pedagogical Content Knowledge (PCK). Content and pedagogical knowledge should not be separated as different types of knowledge; they are complementary and this combination is what makes teaching and learning more meaningful. Content knowledge refers to subject matter knowledge, while pedagogical knowledge refers to those strategies that can make knowledge more comprehensible. Only when the two knowledge areas are combined, teaching becomes effective. Today, however, the educational context has changed a lot, due to the introduction of modern information and communication technology (ICT). Modern ICT is defined in this study as technology that enables people to receive, store, interpret, capture, communicate, exchange and transmit information (Anderson, 2010). Examples of ICT tools include computers, MP3 players, video conferencing, television, digital cameras, memory cards, printers, and mobile phones.

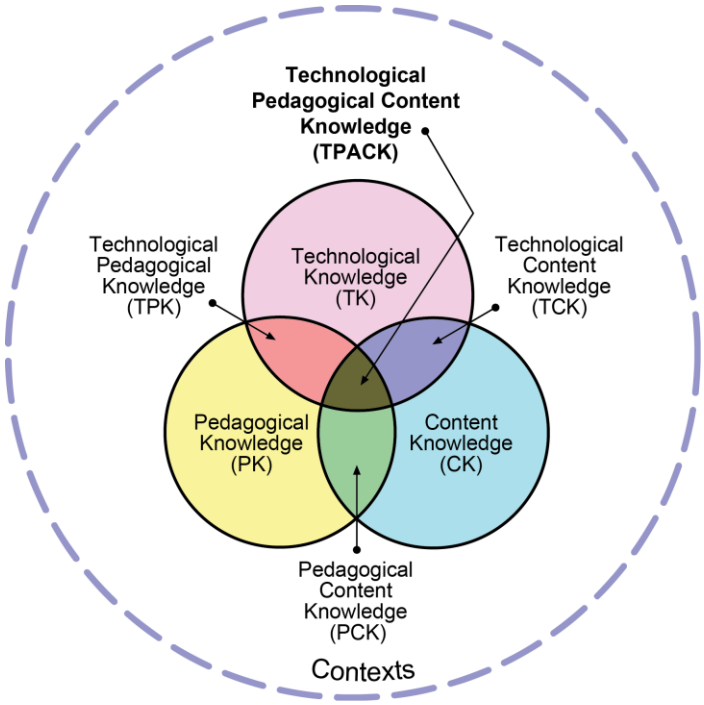

Figure 1: *TPACK Model (Reproduced with permission of the publisher, © 2012 by tpack.org)*

The first core knowledge aspect is *Content Knowledge* (CK), which refers to subject matter knowledge that is to be taught/learned (Koehler & Mishra, 2005). *Pedagogical Knowledge* (PK) makes up the second core knowledge aspect and points to awareness of how students learn, as well as the practices, strategies, processes, procedures and methods of teaching and learning (Shulman, 1986; Koehler & Mishra, 2005). The third core knowledge aspect is *Technology Knowledge* (TK) and refers to understanding how to use modern technologies (for example, the Internet), as well as traditional technologies (for example, overhead projectors). The interaction between these three core knowledge areas generates a combination of knowledge areas as follows:

Pedagogical Content Knowledge (PCK) was coined by Schulman (1986) and reflects the interplay between content and pedagogy to make subject content comprehensible to learners. It includes the understanding of what makes subject content difficult or easy to understand and it refers to the ability to select pedagogy in line with the requirements of effective teaching (Moroney & Haigh, 2011).

Technological Content Knowledge (TCK) is the knowledge of how technology can enhance subject matter content (Koehler & Mishra, 2005) (for example, the use of simulations to show the movement of the earth's tectonic plates).

Technological Pedagogical Knowledge (TPK) refers to the knowledge of the affordances and constraints of technologies and how these can be used to enable different teaching approaches (Koehler et al., 2014; Moroney & Haigh, 2011). For example, a user-friendly and accessible learning management system, containing instructional videos and a discussion forum, can be used to promote flexible, collaborative and individualized learning.

Technological Pedagogical Content Knowledge (TPACK) specifies knowledge regarding the complex interplay between technology, pedagogy and content (Koehler et al., 2014). Quality teaching requires in-depth understanding of TPACK knowledge, which enables educators to develop teaching strategies that are flexible, appropriate and context-specific (Mishra & Koehler, 2006).

Professional Development

It has been argued that professional training of teachers, both initial and continuing, has its most significant impact on beliefs and practices (Hennessy, Harrison, & Wamakote, 2010; Venezky, 2004). Although professional training is crucial for sustainable change and has proven its impact, professional development also faces challenges. Limited resources and large classes impede implementation (Schweisfurth, 2011). An even more persistent limitation is shortage of staff trained in SCL (Schweisfurth, 2011; Tedre, Apiola & Cronjé, 2011). Initial training in new pedagogy is therefore necessary (Kihoza et al., 2016). Despite this insight, pedagogical development is still a neglected area in many universities.

Also in Mozambique there is a great concern about the introduction of SCL and the use of ICT. Despite efforts made by the government to invest in ICT and the introduction of curriculum design policies that foster changes in teaching and learning, traditional teaching and learning is still the dominant approach in many institutions of Higher Education (Cossa et al., 2012; Muianga et al., 2013; Ramos, Tajú, & Canuto, 2011). As ICT and SCL approaches aim to enhance the development of students' competencies (knowledge, skills and attitudes), we can say that both ICT and SCL contribute to the necessary shift to competence-based education. This approach is considered to meet the demands of a knowledge-based society to 'produce' students who can perform well in a dynamic professional environment, now and in the future. The application of TPACK provides a novel perspective to teaching and learning in Mozambique.

Design of a professional development program

Because several studies showed that both ICT and SCL were not well introduced at UEM (Mendonça, 2014; MINED, 2011; Muianga et al., 2013; UEM, 2006; UEM, 2011), a new professional development program was designed based on TPACK. CAD introduced it for the first time in 2013. This new program was composed of 14 modules and took a total of 480 hours for completion. On average, two training courses per year were given for each module, with a focus on how to use ICT as a tool to facilitate SCL. The modules were mandatory for all assistant teachers and a blended learning approach was used, combining e-Learning and traditional face-to-face teaching. The modules included workshops about how to implement project-oriented learning (POL), problem-based learning (PBL), as well as how to incorporate ICT in the various lessons. POL and PBL were chosen as concrete teaching and learning strategies to enhance SCL. ICT was used for two reasons. It is a tool to enhance teaching and learning as well as an accessible digital source of scientific information.

In Table 1 below, the different areas of training in relation to different knowledge areas of TPACK are shown.

Table 1: *Relationship between Core Knowledge and type of training*

Core Knowledge	Type of training
CK	Courses/workshops about a specific knowledge field
	Network of teachers specifically created for the professional development training
	Individual or collaborative research on a topic of interest related to the profession of the teacher
PK	Course/workshop about Student Centred Learning and Teaching methods
	Course /workshop about Problem Based Learning (PBL)
	Course /workshop about Project Oriented Learning (POL)
	Course /workshop about peer tutoring
TK	Course on the use of ICT for teaching and learning
	Course on the use of a LMS platform
	Advanced course on Internet use
	Course on multimedia use
TPK	Course on pedagogical issues regarding the use of specific ICT tools
	Subject-specific course on software for teaching specific content goals

During a period of four years CAD organized more than 95 courses and more than 480 teachers completed the program. The training covered the areas CK (seven training sessions for each course), PK (eight training sessions for each course), TK (eight training sessions for each course) and the overlapping area TPK (five training sessions for each course).

METHODOLOGY

The present study is about an evaluation of the impact of professional development training programs at UEM - after three years of implementation by CAD - on how ICT and SCL can be efficiently integrated. The methodology used is a case study design and quantitative research. TPACK principles were applied to design the data collection instruments. Thus, the same framework was used to analyze the effect of professional development on the transformation of the pedagogical and technological practices of teachers.

Survey Design

In this study, survey questionnaires were used for data collection. To design this questionnaire, several studies about the development of evaluation instruments based on the TPACK model were analyzed (Albion, et al., 2010; Mishra and Koehler, 2006: Schmidt, et al., 2009; Pamuk, et al., 2015). Studies related to the evaluation of the impact of professional development - from the scope of combining ICT and pedagogical innovation - were also used (Moroney & Haigh, 2011; Plomp & Voogt, 2009). Some questions were taken from those studies, for instance from the teacher's questionnaire that was found in the User Guide for the International Database. These questions were transformed and adapted to meet the context of UEM as a Higher Education institution, since the questionnaire was designed for mathematics and science teachers in schools that enrolled students in the target grade that represents the eighth year of schooling (Carstens, & Pelgrum, 2007).

Two groups reviewed the first draft of the questionnaire: five senior experts in the field of ICT and Curriculum Design and a group of teachers who were attending a research methodology course. Based upon the feedback from those experts, the questionnaire was revised and some questions or items were removed or adapted to fit the context of Higher Education in Mozambique.

The final version of the questionnaire included 205 items divided into 24 questions distributed over the following seven sections: (A) Characteristics of the respondents; (B) Professional development training (content, training source); (C) Learning configuration I (teaching units, classroom organization); (D) Learning configuration II (time, (digital) space, use of LMS); (E) Rules regarding university management, ICT coordination, leadership teachers/staff; (F) Pedagogy and ICT use in faculties/schools (curriculum, teaching and assessment methods).

Different response options were formulated, measuring teachers' previous experience with ICT and SCL (on a 5 point Likert-type scale from 'Strongly Disagree' – 1, to 'Strongly Agree' – 5; 'No priority' – 1, to 'High Priority' – 5; 'Never' – 1, to 'Always' – 5) and at the end of each question an open question to collect more related information was used.

Sample characteristics and data analysis

Taking into account the total number of teachers in all faculties, 1707 questionnaires were distributed. The completed questionnaires were collected over a period of one month. 218 questionnaires were returned, but only 147 were fully completed. These questionnaires (approximately 9% of the total of UEM teachers) were analysed, but the final sample used for this study was restricted to 92 respondents. This number of teachers said they used both ICT and SCL in their teaching and learning activities, while 55 (34.7%) teachers replied that they did not use ICT.

In terms of reliability and validity of this study, the questionnaire was designed by using studies that evaluated the impact of professional development from the perspective of using ICT in combination with pedagogical innovation. Five senior experts in ICT and Curriculum design, as well as a group of 23 teachers reviewed the questionnaire. The participants also read and accepted the institutional human subject consent form, in which it was indicated that it was not compulsory to complete the questionnaire. To validate this study, all participants completed the same evaluation instrument. In the first week 94 completed questionnaires were returned, in the second week 37, in the third week only 13, in the fourth and last week only 3 questionnaires were returned. Taking into account the informant consent, which referred to the non-obligation issue, this was considered an acceptable number.

Since the purpose of the study was to verify whether participation in professional development training had induced changes in teaching and learning at UEM and use of ICT in combination with

SCL approaches, the sample in this study was restricted to the respondents who used both. Table 2 shows the distribution of the sample's characteristics. Approximately 1 in 3 teachers in the sample are women. In terms of age, there is a fair division: 55.4% are 35 years or younger and 44.6 % are over 35 years. With respect to academic level, twice as many teachers with a masters (64.1 %) and doctorate (4.3%) degree were trained, than teachers who graduated only at a diploma or certificate level (31.5%).

Table 2: *Teachers' characteristics*

Characteristic		N	%
Gender	Female	34	37.0
	Male	58	63.0
Age	35 years or younger	51	55.4
	Over 35 years	41	44.6
Education	Graduate and Specialization	29	31.5
	Master's degree	59	64.1
	PhD and Post Doc	4	4.3
Years of teaching experience	Up to 5 years	31	33.7
	6-10 years	34	37.0
	More than 10 years	27	29.3
Field of study	Natural and Physical Sciences and Mathematics	32	34.8
	Arts, Social Sciences and Education	32	34.8
	Other*	28	30.4
*Including Medicine and Health Sciences, Engineering and Information Technology and Agriculture and Forest Engineering			

In Table 2 we note that 1 in 3 teachers has up to 5 years of experience (33.7%), just over a third of the respondents has 6 to 10 years of experience (37.0%) and almost 1 in 3 has more than 10 years (29.3%). A similar distribution is also found when we look at the disciplines: Natural Sciences and Mathematics (34.8%), Art, Social Sciences and Education (34.8%), and other areas (30.4%).

Table 3 below shows the number of teachers - who claimed to use ICT and SCL – that participated in one of the courses offered as part of the professional development training and the number of teachers who claimed to use ICT and SCL, but who did not participate.

The training activities focused on the 13 different courses, clustered in the 3 areas of the TPACK model: Content Knowledge (CK), Pedagogical-methodological Knowledge (PK), Technological Knowledge (TK) and the overlapping area of Technological Pedagogical-methodological Knowledge (TPK).

Table 3 also shows the number of teachers who claimed to use ICT and who participated in professional development training and teachers who claimed the same but who did not participate. In addition, we note from the data provided in the table that the number of participants in each type of training ranged from 26 to 88. On average, there was more participation in training sessions related to the area of CK and less in the areas of TPK. Looking at the number of training sessions that were performed by CAD during the three years, more training was given in the areas of CK, PK and TK compared to TPK.

Table 3: *Professional development training, teacher participation and use of ICT and SCL*

TPACK Core Knowledge	Type of training	Participants who use ICT/SCL	Non-participants who use ICT/SCL
		N	
CK	Course/workshop about a specific knowledge field	79	13
	Network of teachers specifically created for the professional development training	77	15
	Individual or collaborative research on a topic of interest related to the profession of the teacher	64	28
PK	Course/workshop about student centred learning and teaching methods	88	4
	Course /workshop about Problem Based Learning (PBL)	45	47
	Course /workshop about Project Oriented Learning (POL)	35	57
	Course /workshop about peer tutoring	26	66
TK	Course on the use of ICT for teaching and learning	81	11
	Course on the use of a LMS platform	67	25
	Advanced course on Internet use	53	39
	Course on multimedia use	31	61
TPK	Course on pedagogical issues regarding the use of specific ICT tools	37	55
	Subject-specific course on software for teaching specific content goals	59	33
* Comparable Groups			

For the analysis of data the 'Component analysis', principles and Cronbach's Alpha Factor were used to construct factors in order to measure the variables that best explain the variability of the data in each dimension. To answer the research questions the following steps were taken:

Step1: Verification of the extent to which the questionnaire is measuring what is intended to be measured and to ensure that the questionnaire is free of error. Were the right dimensions used to measure those elements for which the questionnaire was designed? The Cronbach Alpha analyzed its reliability. The dimensions considered in this analysis were related to the question if, and when yes, what the use of ICT contributed to the teaching practices in the following areas: i) changes in student outcomes, ii) changes in the teaching and learning processes, iii) use in teaching activities, iv) impact on daily life of teachers, v) impact on daily life of students, vi) use in modules or subject activities.

As indicated earlier, the intention was to evaluate the impact of the training by comparing the group that participated in the specific course and the group that did not. One of the important issues was to verify the assumption that these two groups were comparable. If this is the case, it can be said that possible significant differences can be attributed to the intervention (in this case the professional development program).

In step 2 we sought to verify in which respect the characteristics of the teachers who participated in a specific course differed from those who did not participate in that same course.

Step 3: Assuming that the second step has made clear that the two groups are indeed comparable, we now used the t-test for the developed dimensions, to find out how much the participants gained compared to the non-participants.

In order to determine if there is any relation between the perception teachers have of ICT and their participation in professional development, factors were constructed using the main component analysis method to measure the variables that explain most the variability of the data in each dimension of the questionnaire. These dimensions measure the contribution of ICT to the innovation of pedagogical practices: 1) Changes in students' outcomes; 2) Changes in the teaching and learning processes; 3) Use in teaching activities; 4) Impact on teachers' daily life; 5) Impact on students' daily life; 6) Use in modules or subject activities. For each dimension, only one factor was retained and it was given the name of the dimension of the questionnaire. Table 4 summarizes the number of items in each factor, the total variance explained, and the Kaiser-Meyer-Olkin index (KMO) for each factor.

Table 4: *Component analysis principles: Contribution of ICT to teaching practices*

Factors	Number of items	Total variance explained (%)	KMO	N
Changes in students' outcomes	10	70.0	0.822	92
Changes in teaching and learning processes	6	62.0	0.765	
Use in teaching activities	7	55.3	0.772	
Impact on teachers' daily life	8	69.7	0.852	
Impact on students' daily life	9	60.8	0.806	
Use in modules or subject activities	10	67.4	0.787	

For each dimension one component was extracted, in which the variance explained varies from 55.3 (for dimension 'use of ICT' in *Use in teaching activities*) to 70.0 (for dimension 'contribution of ICT' in *Changes in students' outcomes*). All KMO values found in the principal component analyses can be considered to be from medium to good, ranging from 0.765 to 0.852. Different authors rely on the KMO index values, with differences noted for the vale at which the Factor Analysis is appropriate. According to Hair, Anderson & Tatham (1987), the KMO index values are acceptable between 0.5 to 1.0. Therefore, below 0.5 indicates that the factorial analysis is unacceptable. Pallant (2013) states that, for an adequate adjustment of the factorial analysis model, the KMO values should be more than 0.8. In all cases, p values of the Bartlett sphericity test were found to be less than 0.001. This indicates that the correlations between the various items of each dimension are enough to carry out the Component analysis' principles'.

Based on the items retained in each factor, the entire consistency analysis was performed using the Cronbach's Alpha coefficient. Table 5 shows the Cronbach's Alpha values of the items of each of the components. The values range from 0.794 to 0.951, showing that there is consistency of the items that make up these factors.

Table 5: *Cronbach's Alpha Factor: Contribution of ICT to teaching practices*

Factor	Number of items	Cronbach's Alpha	N
Changes in students' outcomes	10	0.951	92
Changes in teaching and learning processes	6	0.868	
Use in teaching activities	7	0.855	
Impact on teachers' daily life	8	0.821	
Impact on students' daily life	9	0.794	
Use in modules or subject activities	10	0.944	

Based on the items that make up the total, the average of each factor was worked out and used to compare participants and non-participants in professional development.

RESULTS

Impact of the training in professional development

In relation to the first question, the teachers were asked in the questionnaire about their perception of the impact of each of the training sessions they participated in. The results are shown in Table 6:

Table 6: *Perceptions of teachers about the impact of training activities*

TPACK Core Knowledge	Courses/workshops	Impact (%)			Number of participants
		Large	Moderate	Other*	
CK	Course/workshop about a specific knowledge field	65.4	34.6	0.0	79
	Network of teachers specifically created for the professional development training	66.7	29.3	4.0	77
	Individual or collaborative research on a topic of interest related to the profession of the teacher	65.6	29.7	4.7	64
PK	Course/workshop about student centred learning and teaching methods	64.8	34.1	1.1	88
	Course /workshop about Problem Based Learning (PBL)	46.7	46.7	6.7	45
	Course /workshop about Project Oriented Learning (POL)	57.1	34.3	8.6	35
	Course /workshop about peer tutoring	53.8	42.3	3.8	26
TK	Course on the use of ICT for teaching and learning	70.4	27.2	2.5	81
	Course on the use of a LMS platform	70.8	26.2	3.1	67

	Advanced course on Internet use	46.2	51.9	1.9	53
	Course on multimedia use	38.7	58.1	3.2	31
TPK	Course on pedagogical issues regarding the use of specific ICT tools	74.6	23.7	1.7	37
	Subject-specific course on software for teaching specific content goals	62.2	29.7	8.1	59
* Include neutral, small and no impact					

According to the results shown in Table 6, the training activities had a considerable impact. Almost all respondents who participated in training activities with a focus on the CK area considered that all courses had at least a moderate impact and more than half of the courses had a large impact. Related to training activities in other areas (such as PK, TK, and TPK), the opinion of the teachers did not differ much from the previous score in the CK area. Although the training activities were attended by less than 50 % of the teachers, more than 50% of the courses were perceived to have a large impact: a) course /workshop about peer tutoring (53.8 %); b) Course on multimedia use (38.7% scored large impact and 58.1 % scored moderate impact); c) Course on Pedagogical issues regarding use of specific ICT tools (74.6%); d) Course /workshop about Project Oriented Learning (POL) (57.1 %). The number of teachers who are of the opinion that the training activities had no impact or a neutral or small impact is less than 9 % in all the training activities. The opinion of the teachers, who participated in the various courses that the training has an impact and the fact that the selected group was really using ICT and SCL approaches, opens up good perspectives that professional development using the TPACK framework, contributes to the adoption of digital technology to make the shift to SCL.

CONTRIBUTION OF PROFESSIONAL DEVELOPMENT TO PEDAGOGICAL PRACTICES AND USE OF ICT FOR TEACHING AND LEARNING

In Table 7 below, the mean and standard deviation of the average of teachers' opinions, among participants and non-participants, as well as the p-value of the T-test for difference of means for these two groups and the d-value of Cohen, are shown.

Table 7: *P-value of the T-test, comparing the contribution of ICT to pedagogical practices between participants and non-participants in professional development activities*

	Participated		Not Participated		p-value (T-test)	Cohen d-value
Courses/workshops	Mean	SD	Mean	SD		
Course/workshop about a specific knowledge field	4.5	.58	4.3	.41	-	0.04
Network of teachers specifically created for the professional development training	4.6	.46	4.0	.80	-	0.13
Individual or collaborative research on a topic of interest related to the profession of the teacher	4.6	.49	4.3	.66	0.031	0.07
Course/workshop about student centred learning and teaching methods	4.5	.56	4.5	.64	-	0.00

Course /workshop about Problem Based Learning (PBL)	4.7	.37	4.2	.60	<0.001	0.20
Course /workshop about Project Oriented Learning (POL)	4.5	.45	4.5	.62	0.987	0.00
Course /workshop about peer tutoring	4.5	.45	4.5	.60	0.922	0.01
Course on the use of ICT for teaching and learning	4.5	.54	4.5	.74	-	0.00
Course on the use of a LMS platform	4.6	.47	4.1	.66	0.002	0.12
Advanced course on Internet use	4.5	.48	4.5	.67	0.779	0.01
Course on multimedia use	4.4	.45	4.5	.61	0.414	-0.04
Course on pedagogical issues regarding the use of specific ICT tools	4.5	.53	4.4	.61	0.363	0.04
Subject-specific course on software for teaching specific content goals	4.6	.49	4.4	.60	0.275	0.03

Based on the results, it was evident that teachers who participated in professional development activities are more likely to use ICT than non-participants. Comparing the two groups shown in Table 7, significant statistical differences can be seen in three out of thirteen pedagogical practices. The first case is a CK type, namely, about Individual or Collaborative Research on a Topic of Interest related to the profession (p-value = 0.031). The findings show that not all teachers have the same opportunities for collaborative research work. At UEM, the senior teachers in the departments are required to involve assistant teachers as a way to enable them to learn about new content and how to do research. By doing so, assistant teachers build up specific expertise in their respective professional areas (CK). However, not all teachers got the opportunity to become involved in collaborative projects with national or international research institutions.

The second case is a PK type, namely about PBL (p-value <0.001). UEM was disseminating PBL between 2009 and 2013 as part of the on-going curricular reform as a result of the Bologna Process to ensure comparability in the standards and quality of HE qualifications. In this reform process, all teachers were involved and the need for innovation was widely discussed in all departments. The focus of the reform was on the introduction of new teaching approaches and the professional development training by CAD was in line with this policy. Even teachers who did not participate in the training activities got some knowledge about this subject, so most teachers were aware of PBL. This may explain why the results indicate no significant difference between the two groups. However, the first implementation of PBL failed. In the new professional training by CAD, teachers gained new understanding.

The third case is a TC type, namely about the use of a LMS (p-value = 0.001). There are significant differences when the two groups are compared. UEM has been implementing a LMS since 2001. More than five different types of platforms were introduced and many teachers were trained. (Muianga & Mutimucuio, 2011). Because of low bandwidth of Internet, lack of maintenance of the servers and not having purchased an official licence, most LMS try-outs were discontinued. UEM has decided to use one single LMS, namely MOODLE, allocated permanent staff for maintenance, and disseminated the use of it for all faculties and schools. Besides that, since 2008 a LMS was also used for fully online distance education courses in the faculties of Education, Economics, Engineering, Social Sciences, Sciences, Agronomy, and Forest Engineering. Analysing the data on the characteristics of respondents (see Table 2), it shows that more than 70% of the respondents are from faculties in which they use a LMS for distance learning.

DISCUSSION

The results from this study confirm what has been referred to by previous studies that professional development has an impact on teachers' beliefs and practices (Koehler & Mishra, 2009; Hennessy, Harrison, & Wamakote, 2010). The data presented in tables 5 and 6 show that teachers who participated and who use ICT believe that ICT contributes to a change in student learning outcomes and to quality improvement of teaching and learning. They also believe that ICT has an impact on the daily life of both teachers and students and they are aware of the important impact of ICT on the subject matter taught in their courses. This suggests that continuing professional development clearly has an impact on teachers' beliefs and practices. Furthermore, the findings of this study show that teachers who attended professional development activities are more likely to use ICT than non-participants (see Table 7). Teachers who participated have a different perception of the importance and impact of professional development in their day-to-day work and their understanding of the pedagogical implications and the potential of training have grown.

Another important outcome that shows the impact of professional development is the fact that the training program used at UEM covered all knowledge areas of the TPACK model, namely CK, PK, TK and TPK. This design combines specific knowledge and the interplay between technology, pedagogy, and content, hence its complexity (Koehler et al., 2014). The great value of the TPACK framework for the design of a professional development program is the fact that it offers a broader view on the use of ICT and it recognizes its contribution to the integration of SCL in teaching and learning practice. Besides, it offers teachers a better orientation and an understanding of how to organize and plan their lesson effectively.

A recommendation that contributes to the effective implementation of professional development activities in regard to the necessary change in pedagogical practices in Higher Education in developing countries like Mozambique, is that training activities should not be organized in isolation nor carried out haphazardly (Schweisfurth, 2011; Tedre, Apiola & Cronjé, 2011). On the contrary, a professional development program that seeks impact must be a program with clear objectives and should be included in the policy and the strategic plan of the university (Mendonça, 2013; Muianga et al., 2013; Ramos et al, 2011; UEM, 2008). Effective training should develop well-identified and continuously demanded competencies, as identified in the TPACK model. Professional development must induce technological and pedagogical changes (TPK). In tables 5 and 6 it can be easily seen that the teachers-participants believe that ICT contributes to changes in students' outcomes and improved pedagogy. They also believe that ICT has an impact on the daily life of both teachers and students, and that ICT plays an essential role in the activities of their subject. Moreover, the data in Table 7 shows that participants are more likely to use ICT in pedagogical practices than non-participants.

Furthermore, the use of a LMS as a tool for teaching and learning is gaining ground at UEM. There are good reasons to say that teachers who participate in training gradually begin to understand the importance of these kinds of tools for the improvement of teaching and learning. The teachers can attribute the benefits that have been achieved to the use of ICT. They have gained expertise through the following:

- Courses/workshops about a specific knowledge field;
- Network of teachers formed specifically for the professional development of teachers;
- Individual or collaborative research on a topic of interest related to the profession
- Courses/workshops about student centred learning and teaching methods
- Course /workshop about Problem Based Learning (PBL);
- Course on pedagogical issues related to the integration of ICT into teaching and learning;
- Subject-specific training about software for specific content goals;

- Course about the use of a LMS platform.

The results of this study showed that some teachers use ICT without having participated in the training. This is due to the individual concern and commitment to the use of technology and to change. These are aligned with the vision, mission, and policy of the institution. Nevertheless, in some aspects there are no significant differences between teachers who participated and who did not. This confirms what other researchers have presented when they refer to the importance of a learning organization, one of the aspects that influences innovation. Personal mastery, which means being committed to lifelong learning in order to develop a special level of proficiency and skill in our day-to-day work, is a core value (Dekoulou, & Trivellas, 2015; Tahmir, & Nawawi, 2016).

CONCLUSIONS AND RECOMMENDATIONS

This study investigated whether participation in professional development activities has an impact on the adoption ICT to support SCL implementation. Based on the analysis done of the questionnaire responses, it can be concluded that professional development has a significant impact on beliefs and practices of the teachers. Training supports the goal of UEM that teachers have to make a shift from traditionally teacher centred instruction to SCL. Teachers who attended the training are more likely to use ICT in their pedagogical practices. Those teachers have a different perception of the importance and impact of professional development in their day-to-day work.

In addition, teachers who participate and who use ICT believe that ICT contributes to changes in students' outcomes and to the quality of the programs offered. They also believe that ICT has an impact on the daily life of both teachers and students and they recognize that it plays an important role in teaching their subject.

To make professional development more effective for teachers, it is important to combine all areas of knowledge: Content, Pedagogy, and Technology. In particular, the Pedagogical and Technological Knowledge areas are crucial for the design of training programs that aim at the catalyst function of ICT to make the shift to SCL. . The combination of Technological Pedagogical Content Knowledge is conditional for teachers to understand the pedagogical implications and the potential of the use of ICT and SCL.

An effective and relevant professional development program has to be aligned to the institutional policy and the strategic planning of the university. The program must stimulate the development of well-identified and continuously required competencies, such as the ones identified in the TPACK framework. Professional development must induce Technological and Pedagogical Changes (TPK). It is important that all teachers have the same training opportunities, so that they can all contribute across the various departments to the improvement of the quality of education in general.

To speed up the implementation of ICT and SCL, the results suggest that in addition to the top – down approach, it is also advisable to use a bottom - up strategy. This implies paying attention to initiatives and recommendations that teachers bring forward. Further, the creation of incentives for small workgroups and initiatives at the faculty and school levels is recommended, since most teachers who are implementing ICT and SCL do this on their own initiative, without having participated in training. Innovation emerges from these groups, as the examples of the faculties of Engineering, Law, Medicine, and Education at UEM show.

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