

# Training Timorese Science teachers in the context of international cooperation: what role could ICT play?

Betina Lopes, Margarida Lucas, Patrícia Almeida, Mariana Martinho

Research Centre for Didactics and Technology in Teacher Education, Department of Education, Campus Universitário Santiago, Aveiro 3810-193, Portugal

## Abstract

The Government of East-Timor has been supporting several approaches to empower national education, since its independence back in 2002. One of the priority areas has been the implementation of in-service teacher training programs in cooperation with higher education institutions from other countries, such as Portugal. In this paper the authors describe and reflect on a particular science teacher training program held in Díli in 2011 in order to discuss the role of ICT towards a better education for all, in line with the recently approved sustainable development goals (SDGs). The autoethnographical approach that was used is conceptually supported on the Model of Situated Perspective on teacher learning and professional development (Borko, 2004). One important output is the fact that Timorese teachers are not the only professionals that need continuous development programs involving ICT. Teacher trainers need it as well in order to be able to integrate it in their teaching practices and support others to do it.

**Keywords:** International Cooperation; Science Education; Teacher Training; Professional Development Model; East Timor; Information and Communication Technologies (ICT); Sustainable Development Goals (SDGs)

*Corresponding author e-mail address: blopes@ua.pt*

## Introduction

In order to empower the national education system, the Government of East Timor has been promoting several in-service teacher education programs, counting with the support of several Higher Education Institutions from other countries, such as Portugal and Brazil, through international cooperation protocols.

Envisaging the 21<sup>st</sup> century as an information and technology based society (Mauaie, Ito & Arnaldo, 2014) it is of crucial importance to reflect on the design of these teacher programs and on the process of their implementation considering the use of Information Communication Technologies (ICT). To what extent are ICT being used as a means to strengthen the technical and pedagogical competences of East Timorese teachers? Are there any missed opportunities considering the use of ICT towards the empowerment of science teachers?

The authors aim to tackle the previous identified issues believing that the outputs of the discussion may be relevant for other academics involved in science education development programs implemented in the context of international cooperation protocols, particularly with developing countries. Considering this goal, this paper draws on four main sections. First a brief summary of the socio-political background of East Timor and its consequences on the educational system is presented. This summary is followed by a brief literature review about the role and potential impact of ICT in educational contexts, as well as a global characterization of ICT in East Timor. After this theoretical and empirical contextualization the authors describe and reflect upon one particular teaching program developed for Timorese science teachers, using this illustrative case as a conceptual scaffold to discuss some key-aspects considering the selected topic. Finally some recommendations are delineated considering the integration of ICT into the design and implementation of effective professional development programs for science teachers, undertaken in the context of international cooperation, in order to promote its impact on teacher learning and teacher practice.

## The educational background of East Timor

East Timor became an independent country on May 20, 2002, after 450 years of Portuguese colonial administration, 24 years of illegal occupation by Indonesia, and 32 months of temporary international administration by the United Nations Transitional Administration of East Timor.

After the 1999 UN-sponsored referendum widespread violence and destruction of public and private property left the nation severely weakened. The country was in ruins and lost almost its entire qualified workforce in all sectors, especially education (Robinson, 2009). Around 90 percent of

secondary teachers, 20 percent of primary teachers and most administrators in the education system were not indigenous East Timorese and departed at this time. Significant loss of life and the displacement of entire communities severely affected the educational system (Heyward, 2005, UNDP, 2002). This historical background poses major challenges for the development of education in this small country. Due to the lack of qualified and experienced professionals in the education sector, the East Timorese Government has been heavily investing in teacher training, mainly in in-service teacher training programs. In fact continuing professional development strategies are considered to be the most effective approaches to prepare teachers adequately and to improve their practice, once they enter the teaching profession (Mokhle, 2013).

Such in-service training programs have been developed through international cooperation protocols, mainly with Portuguese and Brazilian institutions, i.e., institutions from Portuguese speaking countries as Portuguese is one of the country's official languages, along with Tetum, and has been the main instruction language according to the 8<sup>th</sup> article of the Timorese Education System Basic Law (Government of Timor-Leste [GOTL], 2008) at least until 2015.

## The role and potential impact of ICT in educational contexts – a brief literature review

ICT have brought many changes in different areas of our lives, such as in educational contexts (Mauaie, Ito & Arroio, 2014). The importance of ICT as a motor for greater social inclusion, quality of life and competitiveness in the labour market and economic growth is emphasized by various authors and international policy bodies (Erstad, 2010; Redecker *et al.*, 2011; European Commission [EC], 2013; Kampylis, Law & Punie, 2013). In the past decade, there has been a call for educational systems to make ICT an integral part of their teaching and learning processes. As a result, new forms of teaching and learning have emerged as well as new formats of educational resources, such as open educational resources or platforms and digital contents.

In the context of low-income countries, the integration of ICT are reported to be a powerful accelerator to achieve the Millennium Development Goals and the objectives of Education for All (Unwin, 2015). Different authors suggest that they promote educational quality, lifelong learning and the provision of educational opportunities for all (Anderson, 2010; Kampylis *et al.*, 2013; United Nations Educational, Scientific and Cultural Organization Institute for Statistics [UIS], 2014; Unwin, 2015). In addition to these, they have the potential to create highly flexible education

environments, reaching students with poor or no access, especially those in rural and remote regions and to merge formal and informal learning contexts (Anderson, 2010; UIS, 2014). Moreover, they can provide teachers access to high-quality teaching resources and to professional development online (Anderson, 2010; Unwin, 2015).

The effective integration of ICT into Education demands new roles from teachers and students (Anderson, 2010; Resta & Patru, 2010). Changes in teacher roles include a shift from being a knowledge transmitter to becoming a learning facilitator, collaborator, coach, knowledge navigator and co-learner. S/he no longer controls or directs all aspects of learning, but gives students more options and responsibilities for their own learning. As to students, changes include becoming an active participant in the learning process instead of being a recipient of information, producing knowledge and not reproducing it or learning collaboratively with others instead of learning as a solitary activity.

However, the successful integration of ICT into Education requires that governments adopt and develop ICT policies for their education systems and back them with substantial investments in ICT provision. It also requires the consideration of physical conditions, such as electricity and network supply points, computer labs, rooms for servers, placing cables, network points etc.; human resources to set up and maintain such infrastructures; financial resources to support the installation and maintenance of equipment; and well trained school teachers and leaders (Plomp, Anderson, Law, & Quale, 2009; Eickelmann, 2011; UIS, 2014).

Along with a clearly stated vision for ICT use in Education and adequate ICT infrastructure and support, school leaders and teachers are the key to ICT integration (Anderson, 2010; Kampylis et al., 2013; UIS, 2014). School leaders need adequate training in order to be acquainted with the requirements of ICT integration, as well as to support teachers and changes in teaching practices in their schools. Teachers need training on ICT and ICT pedagogical use so that they can integrate it effectively into their teaching for the improvement of student learning.

### **The Status of ICT in East Timor**

Since its independence, in 2002, East Timor has invested considerable funds and energy to rebuild its infrastructures, in an effort to regenerate economic growth and provide the necessary systems and services to enable and enhance the living conditions of its people. The effort to boost the Education and the Telecommunication sector, its infrastructure in particular, has been a key part of this (GOTL, 2002). However and despite the considerable energy that has been going into this rebuilding, the ongoing challenges remain significant.

Data available reveals that there is still an inadequate power supply infrastructure in the country's capital and that it is almost non-existent in

the rural areas. The majority of households, circa 82%, do not have access to electricity, and firewood, plant oils and batteries are used as primary sources of energy by around 98% (UNDP-UNEP: PEI, 2012). Based on figures from the Census 2010, the electrification is mainly concentrated in urban areas, with the electrification rate being 88% in urban areas and 19% in rural areas (GOTL, 2010). Still, even in urban areas there is a high rate of outages particularly in the evening.

A survey conducted in 2011 concludes that 16% of the Timorese population does not access any form of media or ICT (radio, television, newspapers, internet or mobile phones) (United Nations Integrated Mission in Timor-Leste [UNMIT], 2011). Nevertheless, mobile phone usage is increasing and mobile phones are becoming a significant communication tool. Different information sources (da Silva, 2009 UNMIT, 2011; Kelly & Souter, 2014) advance that the telecommunication sector has been expanding with the mobile telephone sector experiencing a strong growth. Data available indicates that nearly 55% of the current population owns a mobile phone and that mobile voice coverage is offered in all 13 districts—covering 92.5% of the population (UNMIT, 2011; Kelly & Souter, 2014). 11% of mobile owners use mobile phones to access the Internet, but the majority (79%) accesses it from Internet cafés as only 0.5% of the population has Internet access at home (UNMIT, 2011). These data seem to be in line with data presented by a report chaired by UNESCO (2013) that refers a 78% growth in mobile broadband services in low-income countries and indicates that such service is often the only access method available in these countries.

As to access to ICT and internet in schools, a recent study concludes that the majority still lacks the basic elements to help build the ICT educational and administrative capacity of schools, such as electricity, telecommunication facilities and appropriate rooms (Lucas & Santos, 2015). The study also found that the government is starting to equip schools and intends to do it gradually. In addition, there are evidences that teachers own their personal laptops and use them to search for information, communicate and prepare tests. Also, that some students use their mobile phones to access the internet in order to look for words, browse the web, check information or visit social networking sites (Cabrita *et al.*, 2015).

Data from other sources, such as the country's National Educational Strategic Plan (NESP) 2011-2030 indicates that it includes a program to fully develop and install the ICT infrastructure and technical support needed to implement modern pedagogy and effective education management and planning (Ministry of Education [MoE], 2011). The initial efforts focus on introducing ICT as a fundamental management tool and on training ministerial staff and educational agents to appropriately use the technology in the normal day to day managerial activities. Despite no or limited

access to ICT infrastructure and resources in schools, the country has already developed its Education Management Information System (EMIS), which collects important data for long-term planning, monitoring and evaluation, as well as operational management of the education system (Santos, Marwata & Sembiring, 2014).

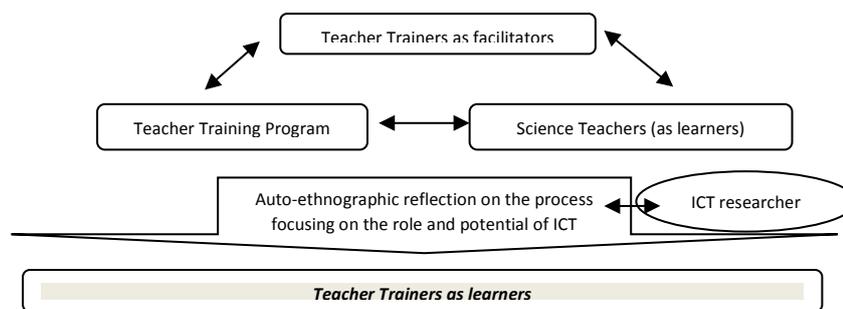
As such, and despite barriers and challenges faced, the country has already moved into the emerging stage of ICT integration (Southeast Asian Ministers of Education Organization [SEAMO], 2010; Anderson, 2010). At this stage, schools are becoming aware of ICT and some begin to purchase, or have had donated, some computing equipment and software. Administrators and teachers are starting to explore the possibilities of using ICT for school management and although practices are still firmly grounded in traditional, teacher-centred practice, national policies and curricula are starting to reflect an increase awareness of the uses of ICT. The NESP is very clear in its vision for its educational system, proposing, for instance, the integration of technological activities into the official general secondary curriculum both as a subject in itself, as well as a means to help change the pedagogy prevalent in schools by moving from a transmission teacher directed methodology towards a greater focus on the individual learner.

**Exploring the use of ICT within and beyond in-service teacher training programs of science teachers**

In order to explore the role of ICT regarding teacher training programs in East Timor, the

memories of the learning-teaching experiences of a group of Portuguese teacher trainers experienced during the 8<sup>th</sup> edition of the teacher training bachelor in East Timor in 2011 (Lopes, Almeida, Martinho & Capelo, 2014; Almeida, Lopes, Martinho, & Capelo, 2014) were revisited. The 8<sup>th</sup> edition of the teacher training bachelor’s degree took place at the National Institute for Teacher Training (INFORDEPE), located in Dili, East Timor. It consisted in 300 hours of training in Science Education, namely in Biology, Chemistry, Mathematics and Physics and included several modules that corresponded to different subjects. A total of 301 teachers attended these science modules, evidencing the recognition of its value towards the development of the country.

The second auto-ethnographical reflection (Hernández, Sancho, Creus, & Montané, 2010; Mitra, 2010) on the learning experience was conducted with the support of an educational researcher specialized in ICT and with experience in teacher training within the context of international cooperation. The adopted approach is conceptually supported on the Model of Situated Perspective on teacher learning and professional development (Borko, 2004) – Figure 1. In a first moment, the authors describe the context and the strategies used during the professional development program focusing on the (non) use of ICT within the sessions. In the second section, an illustrative case considering long term interaction between one teacher trainer and one science teacher is explored in order to deepen and extend the reflection considering the role of ICT within and beyond the training programmes.



**Figure 1** – The process of reflecting on a particular professional development system (adptated from Borke, 2004, p. 4)

**The 8th edition of the science teacher training bachelor’s degree and the use of ICT**

The huge diversity of the in-service teachers’ educational backgrounds was a common feature to all the four science subjects and constituted a big challenge for the trainers, who attempted to level the knowledge of the teachers. Due to the teaching methods usually used in East Timor, which overvalue memorization and the passive acquisition of knowledge (Heyward, 2005), the trainers identified some underdeveloped general competences, which should be strengthened. The initial expectation of the teacher trainers was to

integrate teaching and learning strategies using ICT in the teacher training, such as collaborative Power Point elaboration and presentations, followed by group discussion, since this would constitute a strategy to strengthen these competences and to engage the trainees in innovative teaching and learning strategies.

However, the teacher trainers soon realized that this was not the most efficient approach since it implied basic infrastructures that were not available on a regular basis in the teacher training institution (Lopes et al, 2014). Apart from the frequent electricity supply outages, it is important to

emphasize that the training institution only had one computer room available (with less than 20 computers) which was clearly insufficient considering the number of trainees and the pedagogical aims of the course.

Moreover, the teacher trainers realized that even if there were more computers, it would still be an enormous challenge to accomplish changes in the teachers' daily classroom activity, because the context and setting in which they work every day also lack these infrastructures: "(...) *We brought a video projector to show some power point ... presentations, but when the Timorese teachers described to me their professional context... I thought... How inappropriate. What is needed is innovation through pen and paper and by simple teacher-student talk. What is the point/logic in showing utopic innovation?! Innovative strategies have to be implementable by the teachers at their own school.*"

**The role of ICT after the teacher training program**

After the teacher training program was over, the science teacher trainers maintained professional contact with some of their trainees. E-mails were exchanged mainly in order to help teachers access specific literature and other references, for example in order to prepare practical lessons using lower cost resources appropriate to their own needs at a specific moment. In some cases, teacher trainers also provided some background literature to help the teachers prepare their post-graduation (master) studies, taking opportunity of their possibility in accessing information more easily.

Throughout the five years of (distant) communication between Portuguese teacher trainers and science teachers from East Timor, the consciousness of the Portuguese teacher trainers regarding the importance of ICT towards better and higher impact of professional development strategies, increased. It was indeed this consciousness that triggered the motivation to repeat the auto-ethnographic study with an educational researcher specialized in ICT. Some of the outputs

of the collaborative discussions are presented here. All authors (the teacher trainers as well as the educational researcher specialized in ICT) agree that it is of crucial importance to integrate ICT related strategies that may assist teachers in their daily life in the training programs, even after the programs have ended, since ICT are indeed a powerful tool for global development. ICT help to (i) enhance access and use of information, (ii) promote and facilitate (global) networking and (iii) raise opportunities by giving everyone a voice to share ideas and doubts, according to his/her personal rhythm and needs.

As an illustrative example, Figure 3, transcribes two e-mails from one of the trainees from 2014, two years after the bachelor course ended. In the first e-mail the teacher asks for help to interpret a 'botanical phenomenon' he observed on a coconut. The teacher trainer got into contact with a botanist in order to understand the picture that was sent, compiling afterwards some references related to the phenomenon. The Timorese teacher acknowledged the support in clarifying his doubt (2nd e-mail), and was then able to use the received information and to discuss it with his students.

It was also with the support of the researcher specialized in the domain of ICT and Education that these teacher trainers realized that their vision of ICT, back in 2011, was a narrowed one, being focused mainly on the use of personal computers, video projectors and Internet access. Although one tends to think of ICT as the technologies related with the latest innovations, the term is, in fact, broader referring to all forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means (UNESCO, 2007). These include radio, television, telephone or the DVD for instance. Not acknowledging a broader definition or the potential of ICT for learning, and not acknowledging the particular history of evolution considering the use of ICT in East Timor, may have led to some missing opportunities back in 2011 considering innovation in East Timorese science classes (Figure 4).

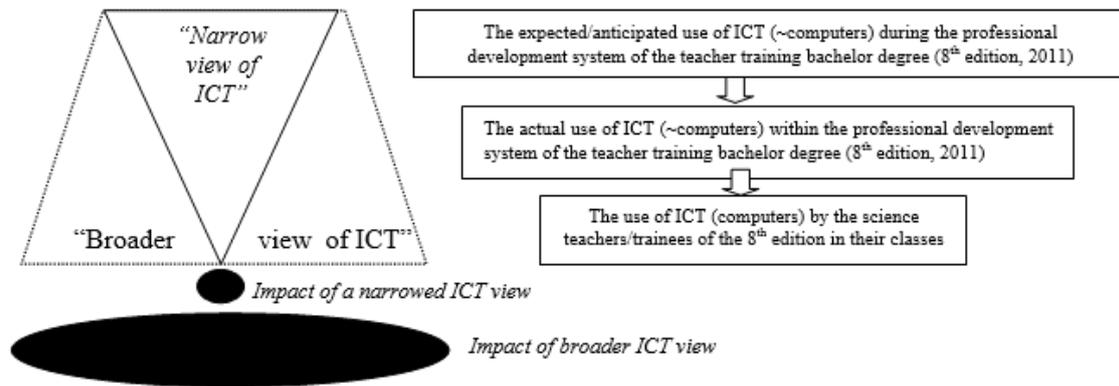
Tuesday, 8 Jul 2014 Subject: Um fenómeno *a phenomenon*  
 Cara Professora, *Dear Teacher,*  
 Envio lhe uma imagem (própria) de coqueiro que germinar ou nascer com dois brotos,  
*I send you an image (taken by me) of a coconut with two growing shoots.*  
 Eu tenho dificuldade de perceber este fenómeno,  
*I have difficulties understanding this phenomenon,*  
 por favor me ajuda a solucionar este problema,  
*please help me solve this problem,*  
 sem outro assunto de momento,  
*with no other issue*  
 antecipadamente grato pela vossa ajuda.  
*grateful in advance for your help.*



**Figure 2 – Illustrative e-mails from a science teacher from East Timor asking for scientific support. <sup>5</sup>**

Back in 2011 we anticipated that the evolution of the use of ICT in East Timor would have been the same as in Portugal. This is first... in Portugal teachers started to use mainly their own laptop to develop their resources and to access the internet... As we realized that the teachers did not have personal computers, we assumed that the majority would not have any opportunity to access the internet by other means or to produce teaching resources using other ICT... therefore this important dimension was not actively prompted by us...

**Figure 3** – An excerpt of the second autoethnographical reflection (2016) of one science teacher trainer considering the use of ICT during the 8<sup>th</sup> edition of the Bachelor Degree (2011).



**Figure 4** – The importance of ICT for considering the impact of continuous development programs for teachers: an example from East Timor

**ICT & Education in East Timor: two main suggestions for future work**

In this paper the authors used an illustrative case to reflect upon the role ICT could play within teacher training programs developed in the context of international cooperation. The major challenges and missed opportunities were highlighted. One key aspect that emerged from the discussion is the need to start considering ICT training also for teacher trainers (not only students or teachers) so that they can (also) be empowered to broaden up the impact of the development program by using a higher diversity of ICT.

It is also important to notice that it was only through this second reflective process that the teacher trainers realized the global scenario of ICT use and that there were other means that could have been used to promote classroom innovation and therefore the impact of the teacher training course (Figure 4), such as the use of mobile phones to record images or videos of the experiments that were implemented. The teacher trainers remember that some of the Timorese teachers asked to take some pictures, which was allowed. However the key-point is that it was not actively promoted and integrated in the didactical strategies that were implemented throughout the course. All three teacher trainers agree that it probably would have led to a greater impact on the professional development of the Timorese teachers and their teaching practices if the possibility of taking pictures or recording small

videos from the experiments would have been considered right from the start.

This aspect leads to the second relevant suggestion, namely the importance of promoting continuous opportunities for reflecting on the experience of developing teacher training in cross border programs (Lopes, Albergaria-Almeida, Callapez & Costa, 2016), which have been increasing in the last years and will continue to increase considering the the recently adopted Sustainable Development Goals, namely Goal 4 (Better Education for all), which aims to “By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing state.”

**Acknowledgements**

The authors acknowledge the support of The Research Centre “Didactics and Technology in Education of Trainers” - CIDTFF, at the University of Aveiro (Portugal). A special word of gratitude to the INFORDEPE staff and to all the teachers from East Timor involved in the 8<sup>th</sup> Edition of the Bachelor Degree, and in particular to Graciano Baptista.

## References

- Albergaria Almeida, P., Lopes, B., Martinho, M., & Capelo, A. (2014). International Cooperation in Education: in-service teacher training in East Timor. *The International Journal of Learner Diversity and Identities*, 19(1), 11-25
- Anderson, J. (2010). *ICT Transforming Education: A Regional Guide*. Bangkok: UNESCO.
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Cabrita, I., Lucas, M., Capelo, A., Ferreira, A., Santos, C., Morgado, M., ... Breda, Z. (2015). *Ensino Secundário Geral em Timor-Leste: Perspetivando o futuro*. Aveiro: UA Editora.
- da Silva, A. P. (2009). TL: Timor-Leste. In P. B. Arinto & S. Akhtar (Eds.), *Digital Review of Asia Pacific 2009-2010* (pp. 351-357). Sage Publications.
- Eickelmann, B. (2011). Supportive and hindering factors to a sustainable implementation of ICT in schools. *Journal for Educational Research Online*, 3(1), 75-103.
- Erstad, O. (2010). Conceptions of Technology Literacy and Fluency. In B. Eva & M. Barry (Eds.), *International Encyclopedia of Education* (pp. 34-41). Oxford: Elsevier.
- European Commission. (2013). *Opening up Education: Innovative teaching and learning for all through new Technologies and Open Educational Resources*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions. Brussels, COM 654 Final.
- Government of Timor-Leste (GOTL). (2002). *National Development Plan*. Retrieved from <http://www.pm.gov.tp/ndp.htm>
- Government of Timor-Leste (GOTL).(2008). Basis of Education. Law n° 14/2008. Retrived from [http://www.cultura.gov.tl/sites/default/files/Lei\\_bas\\_es\\_educacao\\_portugues.pdf](http://www.cultura.gov.tl/sites/default/files/Lei_bas_es_educacao_portugues.pdf)
- Government of Timor-Leste (GOTL). (2010). *Highlights of the 2010 Census Main Results in Timor-Leste*. Retrieved from [http://www.statistics.gov.tl/wp-content/uploads/2014/03/English\\_Census\\_Summary\\_2010\\_2.pdf](http://www.statistics.gov.tl/wp-content/uploads/2014/03/English_Census_Summary_2010_2.pdf)
- Hernández, F., Sancho, J. M., Creus, A., & Montané, A. (2010). Becoming university scholars: Inside professional autoethnographies. *Journal of Research Practice*, 6(1), Article M7. Retrieved from <http://jrp.icaap.org/index.php/jrp/article/view/204/188>
- Heyward, M. (2005). *Lafaek as a Tool to Support Education Improvements in East Timor. Study conducted under the Fundamental School Quality Project* (TF 030630).
- Kampylis, P., Law, N., & Punie, Y. (Eds.). (2013). *ICT-enabled innovation for learning in Europe and Asia: Exploring conditions for sustainability, scalability and impact at system level*. Seville: JRC-IPTS.
- Kelly, T., & Souter, D. (2014). *The Role of Information and Communication Technologies in Postconflict Reconstruction*. Washington DC: The World Bank.
- Lopes, B., Almeida, P.; Martinho, M., & Capelo, A. (2014). What do we learn when we teach abroad? Reflections about International Cooperation with developing countries. *Procedia - Social and Behavioral Sciences*, 116,3930-3934. DOI: 10.1016/j.sbspro.2014.01.869
- Lopes, B., Albergaria-Almeida, P., Callapez, P., & Costa, N. (2016). Investigating Science Education in the context of International Cooperation for development: the case of the Portuguese public higher education institutions. Conference Proceedings of the International Conference New Perspectives in Science Education (5th Edition), 17-18 March 2016, Florence, Italy.
- Lucas, M., & Santos, C. (2015). The integration of ICT in the new Timorese General Secondary Curriculum. *Indagatio Didactica*, 7(2), 29-42.
- Maueie, C., Ito, L.S., and Arroio, A. (2014). Media Literacy and Health Education: empowering teachers in the Republic of Mozambique. *Problems of Education in the 21<sup>st</sup> century*, 60, 114-122.
- Ministry of Education (MoE). (2011). *National Education Strategic Plan 2011 – 2030. Timor-Leste: Ministry of Education*. Retrieved from <https://www.moe.gov.tl/pdf/NESP2011-2030.pdf>
- Mitra, R. (2010). Doing ethnography, being an ethnographer: The autoethnographic research process and I. *Journal of Research Practice*, 6(1), Article M4. Retrieved from <http://jrp.icaap.org/index.php/jrp/article/view/184/182/>
- Mokhele, M. (2013). Empowering teachers: an alternative model for professional development in South Africa. *Journal of Social Science*, 34(1), 73-81.

- Plomp, T., Anderson, R. E., Law, N., & Quale, A. (Eds.). (2009). *Cross-national information and communication technology: policies and practices in education*. Charlotte, N.C.: Information Age Publishing.
- Redecker et al. (2011). *The Future of Learning: Preparing for Change*. Seville: JRC-IPTS.
- Resta, P., and Patru, M. (Eds). (2010). *Teacher Development in an E-learning Age: A Policy and Planning Guide*. Paris: UNESCO.
- Robinson, G. (2009). "If You Leave Us Here, We Will Die": How Genocide was Stopped in East Timor. New Jersey: Princeton University Press.
- Santos, A. T., Marwata, M., & Sembiring, I. (2014). EMIS Information Systems Audit on the Timor-Leste Education Ministry with a COBIT4. 1 Framework. *International Journal of Computer Applications*, 89(5), 20-30.
- Tornero, J.M., Varis, T. (2010). Media Literacy and new humanism. Paris: UNESCO Institute for Information Technologies in Education. Retrieved from: <http://unesdoc.unesco.org/images/0019/001921/192134e.pdf>
- Southeast Asian Ministers of Education Organization (SEAMEO). (2010). *Status of ICT Integration in Education in Southeast Asian Countries*. Bangkok: SEAMEO.
- United Nations Educational, Scientific and Cultural Organization (UNESCO).(2007). The UNESCO ICT Education program. Paris. UNESCO. <http://unesdoc.unesco.org/images/0015/001567/156769e.pdf>.
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2013). *Technology, broadband and education. Advancing the Education for All Agenda*. A report by the broadband commission working group on Education. Paris: UNESCO.
- United Nations Department of Economic and Social Affairs (2015). *Sustainable development Goals – SDGs*, available at: <https://sustainabledevelopment.un.org/topics>.
- United Nations Development Program (2002). *Ukun Rasik A'an, The Way Ahead – East Timor Human Development Report 2002*. Dili, East Timor: UNDP.
- United Nations Development Programme - United Nations Environment Programme: Poverty-Environment Initiative (UNDP-UNEP: PEI). (2012). *The context of poverty-environment mainstreaming in Timor-Leste*. Retrieved from [http://www.unpei.org/sites/default/files/country\\_fac sheets/Fact%20Sheet\\_Timor%20Leste\\_2011.pdf](http://www.unpei.org/sites/default/files/country_fac sheets/Fact%20Sheet_Timor%20Leste_2011.pdf)
- United Nations Educational, Scientific and Cultural Organization Institute for Statistics (UIS). (2014). *Information and Communication Technology (ICT) in Education in Asia: A comparative analysis of ICT integration and e-readiness in schools across Asia*. Quebec: UNESCO-UIS.
- United Nations Integrated Mission in Timor-Leste (UNMIT). (2011). *Timor-Leste Communication and Media Survey*. Dili: UNMIT.
- Unwin, T. (2015). *Evolution and prospects for the use of mobile technologies to improve education access and learning outcomes*. Paper commissioned for the EFA Global Monitoring Report 2015, Education for All 2000-2015: achievements and challenges. UNESCO. Retrieved from <http://unesdoc.unesco.org/images/0023/002324/232450e.pdf>