Abstract
This paper discusses the STTP project (Support to Teacher Training Programmes) which was implemented from 2004 – 2009 at the Pedagogical University (Universidade Pedagógica, UP) in Mozambique. The development of learning materials and their use in workshops and in pre-service and in-service training has been the central theme of project activities. The paper also looks at the ambitions and realities, effects and impacts, and also at difficulties and lessons learned.

Context, background and project objectives
The STTP project was designed during 2003 by the Ministry for Higher Education, Science and Technology (MHEST) in Mozambique and the NUFFIC, the Dutch organisation in charge of the NPT programme and commissioned to this effect by the Dutch Ministry of Development Cooperation. The project identification was based on inputs provided by the two intended beneficiaries: the Universidade Eduardo Mondlane (UEM), and the Universidade Pedagógica (UP). The project outline was published in September 2003 and Dutch institutions for Higher Education were invited to submit proposals. As an important justification for STTP, the project outline stated that “... the MHEST expects the NPT project to help improve the quality and access of the teaching and learning process within the educational institutions at all levels. Improving quality of teachers’ training at Higher Education level will definitely help to improve the efficiency in the whole educational system. With better teachers the dropout rate is expected to decrease. Increasing the rate of success, more efficiency in the system is expected. All this will help the country to improve the quality of its human capital and access to higher education, a critical resource for the fight against absolute poverty in the country.”

The overall objective at the level of MHEST was “... to enhance the quality of teaching and learning in the Mozambican educational system by delivering more and better prepared teachers to secondary schools and higher education institutions.” According to the project outline, the project was “to be conducted in cooperation with, and for the benefit of, the Ministry of Higher Education, Science and Technology. The MHEST will be responsible for a sector
wide impact of the two institution based projects.” This suggested that the MHEST was the main beneficiary of STTP. This interpretation was enhanced by the inclusion of four specific objectives at higher education sub-sector level thus creating problems in the design of the project. Despite the apparent focus on the Ministry, the project outline did not specify Ministry-based outputs, nor did it include a budget to achieve these. As a consequence, no STTP-related activities took place supporting the Ministry.

Two institution-based sub-projects were formulated at UEM Faculty of Education (UEM-FacEd) and at UP in the Faculty of Natural Sciences and Mathematics (UP-FCNM). This paper focuses on STTP at UP because the activities there were more comprehensive than at UEM-FacEd\(^1\). The overall objective of STTP was “...to improve the quality of the teaching and learning process at secondary school level, by enhancing the UP staff capacity to assist teacher students and in-service secondary school teachers in realizing pedagogical events (workshops, short courses, seminars, conferences, exhibitions, etc.) in the subject areas: mathematics, natural sciences and languages.”

Two short-term objectives were defined to be achieved at UP:
1. To enhance the staff capacity to develop educational materials in three areas: mathematics, natural sciences and languages;
2. To improve pedagogical practices through the use of educational materials in pedagogical events.

Early in the inception phase (February - April 2004) it was decided to leave out the area of languages. Amongst the reasons for this decision was that these were already supported by other countries (Portugal, England and France) and the Dutch implementers could not add value to these contributions. The project finally decided to concentrate on 5 areas: mathematics, biology, chemistry, physics and geography.

The Universidade Pedagógica, UP
UP Mozambique (www.up.ac.mz) was established in 1985 by the then Ministry of Education and Culture (MEC) with the brief to train teachers for secondary schools. Later, other programmes were developed to train upper primary school teachers and staff for the primary teacher training colleges. UP opted for a decentralised approach following its establishment and has set up satellite branches (delegaçõ) outside Maputo, starting in Beira and in Nampula in the late 1980s. UP now offers teacher education programmes in 7 of the 10 Mozambican provinces; the three remaining regions will be served from

\(^1\) STTP at UEM-FacEd completed a wide range of activities that had been initiated in three earlier cooperation projects.
2009 (Figure 1). In 2007, UP had 31,695 students registered in all education programmes. The STTP project concentrated on four branches: Maputo, Beira, Nampula and Quelimane (the 2004 dots on the map). At these branches, Core Teams (Núcleos) were created (see Box 1). Over the years, more branches opened and the project tried to support these as well, albeit only in a modest way.

Figure 1: The satellite branches of UP in the Mozambican provinces

UP has received substantial support from the World Bank Higher Education Project (HEP). Some examples are the building of science laboratories in Maputo, refurbishing UP facilities in Beira and acquiring textbooks and other materials in Nampula. The Faculty of Natural Sciences and Mathematics (Faculdade de Ciências Naturais e Matemática, FCNM) had 19% of all UP students in 2007. The courses offered by the FCNM are at Bachelor and Licenciatura (equivalent
to Bachelor Honour) levels in biology, chemistry, computer science, mathematics and physics. About 70% of the FCNM staff, especially those teaching in the provinces, received first degrees from UP and have little teaching experience in higher education. Some 21% of UP staff have a Masters degree and 9% are PhD holders. Since 2008, UP also offers Masters programmes at FCNM in mathematics, biology and physics education, with other subjects following soon. Finally, UP offers evening programmes to students who are employed in other sectors than education, as well as a crash programme of one year to train lower secondary teachers. The evening programme does not train teachers; rather it provides professional development to people who are already professionally active. In 2007, UP, responding to MEC, established a one year emergency programme (intended to be a temporary one), addressing the acute shortage of junior secondary teachers.

**STTP - the ambitions in the project outline and the realities on the ground**

The project outline for STTP showed high expectations. Two of these are discussed now as they had an impact on the further development and implementation of the project. These were (i) to establish and make operational four specialised Resource Centres (RCs), and (ii) to staff the RCs with Core Teams (CTs), including staff training, 6 of these to Masters level (Box 1).

The allocation of physical space for the RCs by senior UP management was not easy. This is not surprising since UP had gone through significant expansion in recent years with increasing student numbers and consequent mounting pressure on existing facilities. Increased physical space was (partly) to come from the HEP project (World Bank) and from other investments. By the end of 2006 (Year 3 of STTP), all 4 branches had their RC established and equipped with office and e-communication equipment and some basic furniture while the project provided additional educational resources and books. By 2007/2008 this also happened in Beira and Maputo. The main users of the RCs were the Core Teams and other UP lecturers. RCs were hardly used at all by secondary school teachers. Due to the mounting pressure on physical space, the Nampula RC was reclaimed by UP-Nampula management in the early months of 2009.

Besides facilities, good communication between RCs was a basic condition for the functioning of the RCs, especially when specialised and complicated tasks of developing educational materials (videos and software) were to be assigned to them. As with facilities, the reality was somewhat different. While the project equipped all RCs with computers and potential for e-connectivity, the IT-infrastructure, especially outside Maputo was poor and e-mail contact with branches outside Maputo was often problematic and at times, impossible.
Box 1: Description of Resource Centres and Core Teams in the original project outline (2003).

Resource Centres are new centres to be established at each UP branch. An RC is the physical space, i.e. room/s where technical equipment (computer equipment, audio & video equipment, etc) will be located for the development of educational materials. In order to create the RCs - as a primary condition to run STTP - the UP is upgrading existing rooms at UP-Maputo to create a pilot RC where the first experiences in the development of educational materials will take place. Subsequently in 2004, RCs in Beira, Quelimane and in Nampula branches will be created. In order to decentralise the tasks of the project and avoid duplication, each RC will develop a certain type of educational material. For instance, the Nampula-RC could be assigned to develop textbooks, the Beira-RC to develop videos, the Quelimane-RC to develop software and the Maputo-RC to develop manipulative kits. This is a matter to be discussed by the CTs of the four UP-branches.

Core Teams are new teams composed of permanent UP staff in charge of pedagogical and technical activities in the RCs. For each branch, the project is creating a CT composed of two didactic specialists for each subject area. The CT also needs two ICT specialists to deal with technical issues of multimedia production. It is desirable that all CT members should have a Masters degree in education or ICT training in development of didactic materials or in related areas. The UP will assign candidates to CTs who have a Licenciatura or a higher academic degree. The candidates will undertake part of their training (short-term courses and workshops) locally in Maputo, Beira, Quelimane and Nampula, while those who need more capacity building may take a degree programme in the Netherlands under the Dutch partner guidance or elsewhere in the region.

Setting up the Core Teams (CTs) was completed in the early stages of the project. In each UP branch a group of lecturers was identified for further involvement in STTP-related activities, such as capacity building, training and study visits and as facilitators in pedagogical\(^2\) events. Senior staff from UP-Maputo (usually a PhD degree holder) was appointed as subject coordinator in each area, so there were five in total.

This group, together with the STTP project coordinator constituted the group of UP counterparts to the Dutch expert team. The two groups together were responsible for the planning and delivery of the majority of the STTP activities. Most of the CT staff outside Maputo had recently graduated from UP itself and few had a Masters degree. Yet another reality was that desired staff specialisations mentioned in the project outline were absent.

\(^2\) Pedagogical events were defined as seminars and workshops for practicing teachers, teaching practice and coursework for pre-service teacher trainees, and internal UP staff development programmes.
The situation on the ground with the RCs and the CTs was at odds with the outline requirements for setting up the specialised RCs. Although it was never made explicit in the early years of the project, the idea of developing specialised RCs in the first phase of the project was quietly dropped.

**The concrete activities of STTP at UP**
The activities of STTP are discussed chronologically rather than by content area to provide a clearer picture on the development and evolution of the project. Due to end by 31 December 2007, the donor granted the project a budget neutral extension in 2008 and 2009 because of the long strategy building phase and late start of formal staff training.

*Strategy Building: securing STTP firmly within UP in 2004 and 2005*

In the initial phase of the project, the intended interventions and STTP strategy were prepared and discussed with the partners and firmly rooted in the existing context and constraints.

The first concrete project activities attended to:

- securing support from all stakeholders inside UP (including its branches) as well as from MEC at central and at provincial levels. This was much needed as there was a significant gap in ownership between the designers of the project (e.g. the Core Team in Maputo) and staff in the other UP branches and the MEC
- formulating the professional profiles of the Core Teams, identifying staff for CTs, formally creating them and initiating on-the-job training at four UP branches
- founding the Resource Centres and beginning to equip them
- carrying out a base-line needs assessment amongst 340 secondary school teachers (Abdulcarimo, unpublished)
- identifying staff for formal training in overseas Masters programmes.

In October 2005, the strategy building phase culminated in the first UP-wide seminar with all Core Teams attended by about 25 staff. It was held in Nampula and focused on:

- analysing and refining prototypes of learning materials produced so far by the 5 STTP subjects since June 2005
- learning more about designing, validating, developing and piloting educational materials
- discussing issues on organisation of workshops for secondary school teachers and tutors for teaching practice.

This workshop finished with a much better understanding amongst the Core
Teams on materials development, including challenges and pitfalls, and the different target groups (teachers, teacher trainees, tutors). Agreement was reached on detailed planning for activities with teachers for implementation in 2006. Plans were also made for the procurement of resources. In addition to the communications and office equipment, the project acquired science education resource materials, books and basic laboratory equipment such as microscopes and RADMASTE micro-science kits.

The implementation of STTP activities with teachers and UP staff
The implementation of pilot versions of the educational materials started in 2006. Eighteen workshops were held countrywide in two rounds (April and October) with the participation of about 380 teachers. The workshops were conducted at two secondary schools (Namaacha, Guruè) and at UP branches in Beira, Nampula, and Quelimane by UP-Maputo and Dutch expert teams who had jointly prepared the training sessions. The participation of ESG teachers was facilitated with paid travel and accommodation by the Provincial Directorates. During these workshops, participating teachers were also encouraged to implement cascading training sessions in their schools. The initial steps of the implementation of STTP are documented by Cherinda (2007).

The need for flexibility in the STTP programme became evident in the beginning of 2007. The Ministry of Education then announced a fundamental change in the school calendar because of the August 2007 National Census. This provided insufficient time to work with the teachers as in 2006. Therefore, STTP twice provided short and intensive training to about 70 - 80 junior UP staff. For each, a theme was selected which was jointly prepared and delivered at various locations on ‘systematic problem solving’ and later on ‘evaluation and student assessment’. In the later workshop, staff also participated from recently established UP branches in Lichinga and in Cabo Delgado.

During 2008, UP staff continued to provide in-service training to secondary school teachers in Beira, Nampula en Quelimane. Workshops had a duration of two days and were organised and conducted by the CTs. The participation of 120 secondary teachers was facilitated (travel, accommodation) by the Provincial Directorates – showing their interesting and commitment to INSET activities implemented by UP. In all cases, several secondary schools were represented and most schools sent one or two teachers, increasing the coverage of schools and intensifying the relations between UP and the schools in their region.

Staff training
The training of staff is an essential element of capacity building programmes.
In STTP, staff development took both informal and formal forms. Several types of informal opportunities were available. The first was through visits of staff from UP-Maputo and Core Teams to the Netherlands, South Africa, Swaziland and Namibia for tailor-made training in materials development, exposure to similar activities and attendance of conferences in the region. A second element of informal training was the close cooperation between the expert teams and junior UP staff during the preparation and delivery of workshops and the annual working conferences. The continuity in participation of the same group of junior lecturers from 2005 – 2008 has been an important strength of the project.

The formal staff training proved more difficult to arrange. Language was a major obstacle and the project went at great length to support English language training for UP staff (see the following section), without achieving the desired results. In September 2007, two staff started Masters programmes at the University of Lisbon (Portugal) in ICT in Education and in Mathematics Education. Their studies progressed well and they completed their studies successfully without any delays in July 2009. The fieldwork was done in Mozambique on topics directly related to daily practice involving secondary school teachers and students.

Further staff training was initiated at UP itself with the establishment of a Masters in Education in 2008. This was initially intended for UP’s own staff, but will be opened up for others in the near future. STTP support has been quite modest with one Dutch expert providing co-teaching input in the Masters in Chemistry Education in May 2009.

Lessons learnt and constraints

A number of critical issues and constraints that emerged during project implementation have been documented (Cherinda & Kool, 2008, 2009). Some have been alluded to earlier in this chapter.

Language was a critical issue on both sides. Sufficient mastery of Portuguese was essential for workshops delivered outside Maputo. This restricted the number of experts available with the right combination of language and professional experiences. Few UP staff from outside Maputo mastered English so that all the training and educational materials used in STTP were in Portuguese. Furthermore, it was not easy to identify UP staff with sufficient mastery of English to be eligible for further training in South Africa or in Europe. This would have provided an excellent window on the world outside the Portuguese language domain. The fact that modern resources in Science and Mathematics Education are published in English is an additional argument. The authors
suggest that language training of key staff should be an essential element in any project strategy and budget in non-English speaking countries.

The project outline was very ambitious, especially regarding the four resource centres, each with a different role and responsibility: on textbooks, software, videos and multi-media, and school equipment. Finding physical space for these RCs took more time than anticipated and recruiting qualified staff was another complicating factor. In the end, they were established and basically equipped, but their envisaged advanced specialisation levels were not achieved. The appraisal of the initial project outline by the donor agency (NUFFIC) should be more analytical of the ambitions formulated and the realities that can be expected on the ground.

Development of learning materials for use in training and seminars was one of the focal points in STTP. A lot has been achieved in this respect, but the following aspects need more attention in future:

• educational research into the use and effectiveness of the materials when and where they are used
• further improvement and dissemination of the materials to relevant stakeholders in schools and other training institutions
• greater involvement of the actual users (teachers and teacher trainees) in the development and validation of these materials.

Logistical aspects of STTP have been very demanding and complex because of UP’s geographical coverage of Mozambique. For example, the one Faculty of Natural Sciences and Mathematics is responsible for all science and mathematics education programmes in all UP branches. The need for a reliable and effective communication system to coordinate meetings and workshops is clear. E-communication is available only to a limited extent, especially within and between the provincial branches. Consequently, a lot of effort is needed to maintain professional and organisational contacts between all UP branches.

Professional development through materials development

The approach to professional development in the project was based on the model of Joyce and Showers (2002). They have identified three phases:

1. the training needs are identified democratically by asking the teachers themselves what they need, leading to one common goal for a particular training
2. the training mode is designed and the outcomes formulated, including transfer to the classroom
3. the training is implemented.
Implementation of training - eg the actual workshop, is then characterised by five components: theory, demonstration, practice, feedback and coaching.

Joyce and Showers’ studies on the effectiveness of more than 200 training components revealed that the combination of the theory, demonstration, practice, and feedback components were effective in settings that focused upon awareness, knowledge, and skill development. However, when the goal of the workshop relates to the integration and transfer of complex ideas or requires significant modifications to teaching method, only the combination of all five components is effective for the transfer of training to the classroom.

The two main monitoring and evaluation instruments applied when designing and implementing the STTP workshops were:
1. post-workshop participant evaluations, and
2. facilitators’ own workshop and training evaluations

This section gives a first impression of the analysis of these instruments.

1. Participant evaluations
Workshop evaluations show that teaching of natural science needs to be improved, particularly through introducing more experimental work in class. Better laboratory materials are needed, while teachers also need training on how to use learning materials and equipment in their classes. Teacher trainees and junior UP staff need to build confidence in using equipment in class and to expand their own experience. Evaluations show that teachers are able to produce some alternative didactical materials for their students – especially in physics. Learning materials for students alone is not sufficient and need to be supported with additional materials such as teacher guides. These seem to be more effective when they contain a small number of exemplary lessons covering the start to a new topic. In addition, semester teaching plans are of great help to beginning teachers. Workshops built around central pedagogical themes such as ‘active learning’, ‘assessment’, ‘practical work and demonstrations’, ‘teaching large classes’; hands-on experience and connecting with learning materials were appreciated by junior staff. We conclude that opportunities to acquire pedagogical content knowledge (PCK) should always be incorporated into learning materials and workshops.

Participants appreciated and valued the opportunities to meet and to work together in order to exchange experiences and to learn from each other. The eagerness to improve professional skills was striking. Finally, the support
from institutional management (Provincial Directorate, UP management) was judged conducive for having successful training sessions; successful in terms of logistics, planning, efficiency and continuity in participation.

2. Facilitator evaluations
Facilitators revealed that working with secondary school teachers made them learn more about teaching and learning and conditions in schools as they prepared the workshop materials. Most of the UP facilitators had no previous training on writing learning materials. They are now aware that they must produce educational materials that address pedagogical content knowledge in the Mozambican context, together with realistic planning and semester teaching schedules. Facilitators also reported that they had acquired a much better understanding of the real situation in schools, especially in the rural areas. Perhaps the most significant outcome is that the project managed to establish and strengthen links between UP (teacher education and service provider), schools (where it all happens) and the Ministry (the ‘client’). Facilitators also gained experience in producing instruments for experiments using low cost material (in physics).

Finally, it emerged that improved validation and much closer monitoring of the use and impact of the educational materials is required. There are plans to introduce a third instrument to evaluate the classroom use of learning materials by secondary school teachers and UP staff.

An intermediate balance and the way ahead
STTP managed to follow the steps suggested by Joyce and Showers (2002) as shown in the checklist (Table 1).

While most steps have been achieved, the project was not able to provide the essential and systematic feedback and coaching in the schools. However, the materials produced are already being used by secondary school teachers in their lessons in draft form. Many teachers confirm they now have at least one additional resource apart from the student textbook. Another indication of acceptance of the learning materials is that MEC has reproduced some chemistry modules and distributed them to secondary schools.

More research will be required on the classroom implementation of the modules. The new Masters programme at UP could provide this type of research. About 50 junior staff from UP branches across the country started the part-time Masters of Education in February 2008. Educational research constitutes a key element and more substantiated findings should result from assignments on teaching practice and final projects.
Table 1: Checklist of steps against achievements using the scheme of Joyce and Showers.

<table>
<thead>
<tr>
<th>Phase and What?</th>
<th>Done?</th>
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</thead>
<tbody>
<tr>
<td>1. Initial needs assessment</td>
<td>Yes (Abdulcarimo, unpublished)</td>
</tr>
<tr>
<td>2. Devising the training, including evaluation of interventions</td>
<td>Yes: workshops, seminars, evaluations (Cherinda &amp; Kool 2008, 2009)</td>
</tr>
<tr>
<td>3. Implementation</td>
<td></td>
</tr>
<tr>
<td>a. Theory; explain and justify the new approach</td>
<td>a. Yes</td>
</tr>
<tr>
<td>b. Demo: show/model how it can be done in practice</td>
<td>b. Yes</td>
</tr>
<tr>
<td>c. Practice: let the teachers try doing it this way</td>
<td>c. Yes</td>
</tr>
<tr>
<td>d. Feedback: give the teachers feedback on their use of the new way</td>
<td>d. Yes</td>
</tr>
<tr>
<td>e. Coaching: help teachers work out what to do next to improve their new approach.</td>
<td>e. Yes</td>
</tr>
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Final remarks

The STTP project came to an end in the course of 2009. This also marked the end of CIS-VU involvement. A follow-up project is being implemented by Fontys University of Professional Education. The activities initiated in STTP were expected to continue, although UP-Maputo did not conduct any in-service activities in 2009 (unlike Beira, Nampula and Quelimane) and only one such event in 2008. This is of concern because STTP was starting to have an impact on the Mozambican educational system.

Inevitably, the question arises about the sustainability of project results. The 2009 STTP Final Report indicated that activities were fully embedded in the institutional and organisational structure of UP; no real separate project structure had been created. Management continuity was assured when the project coordinator, Dr Marcos Cherinda was appointed Dean of the Faculty of Natural Sciences and Mathematics in 2008. This faculty was the home of STTP and the two project coordinators produced a document for consideration by UP management describing the essential business of RCs and CTs and associated operational aspects (logistics, staffing, costs).
An important aspect of academic sustainability is the number and the continuity of academic staff participation in project activities; workshops, seminars and training. About 60 - 80 staff from all four branches (including more than 20 Core Team members) participated in one way or another in the STTP activities. To achieve continuity, the working contacts and cooperation between lecturers in charge of subject specific didactics and those involved in project activities can be improved. The start and the completion of formal staff training within the timeframe of the project is important for academic sustainability. That aspect has not fully been realised; only two staff received Masters training. However, the UP-based Masters training for many of its younger staff is an important step towards academic sustainability.

Achievement of technical sustainability improved markedly between 2007 and 2008 with all four CTs becoming operational and equipped with supporting infrastructure, physical space and resources. The continuation in CT functioning and the RCs will remain an important aspect in the follow-up project. Ways to integrate the RCs into existing UP structures will need due attention. The new lab. facilities in Maputo will be helpful, especially when fully equipped with furniture and laboratory equipment. Improvement in e-communication depends not on STTP, but on a sister NPT funded ICT project. ICT improvements are already visible at UP – Maputo, with improved Internet access and UP-based e-mail addresses.

It is anticipated that full financial sustainability will be a difficult target in an expanding educational system – both nationally as well as institutionally. Nevertheless, MEC and Direcções Provinciais have already contributed to the project activities during workshops with teachers. Part of the revenues obtained from selling the modules and other STTP publications will be used as a recurrent fund for Faculty publications in the future.

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We dedicate this chapter to two UP colleagues who contributed so much, but who passed away during STTP: Jone Gonçalves from Quelimane (in October 2007) and Mário Jorge Cuamba from Maputo (in June 2008). We acknowledge the support from the Dutch government to the STTP project (NUFFIC grant CF 1055B) and from the Mozambican government and the support and input from our science education colleagues in Maputo and the Netherlands.
References


