CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

This chapter introduces the study on investigating and improving assessment practices in Physics in secondary schools in Mozambique. In Section 1.1 the research problem is introduced with a focus on the structure of the Mozambique educational system and the problematic situation connected with secondary education and qualifications of secondary school teachers. Section 1.2 presents the research problem and aims of the study leading to the main research question of the study. A more detailed elaboration of this question follows in the subsequent chapters. The research approach of the study is discussed in Section 1.3 where the pragmatic knowledge claim is stated as the scientific basis for the study. The schematic representation of the steps to be followed in order to answer the main research question is also presented in this section as a research model of the study. The model is elaborated into four main components namely, research goal, research object, research perspective and research activities. Finally, Section 1.4 presents an overview of the chapters.

1.1 Introduction of the research problem

After many years of colonisation, and in line with many other countries, Mozambique has implemented its own National Education System. The Mozambique National System of Education (SNE) comprises ten subsystems, namely: general education, adult education, technical and vocational education, teacher education, higher education, special education, distance education, school health and sanitation, sports, and school production and food. There are four levels of education: primary, secondary, intermediate and higher education. The subsystem of general education is composed of primary education (lower and upper) and secondary education (cycles 1 and 2). General secondary education, cycle 1 (ESG1),

comprises Grades 8, 9 and 10, and the general secondary education, cycle 2 (ESG2), comprises Grades 11 and 12. In cycle 1 the students have ten subjects namely Biology, Chemistry, Drawing, English, Geography, History, Mathematics, Physics, Physical Education, and Portuguese. In cycle 2 French and Philosophy are added, while students can choose one of the three existing streams, depending on what they would like to pursue at university level: sciences, humanities, or social sciences (MinEd, 2004). The purpose of this study is to investigate and improve assessment practices used by secondary school Physics teachers in Mozambique and will focus on the Science stream of ESG2. In 2006 the enrolment figures for general secondary education (ESG) were 293,179 students, which can be broken down into 257,729 students enrolled for ESG1 and 35,450 students enrolled for ESG2. The public school network under the Ministry of Education and Culture (MEC) was composed of 265 schools of ESG. Of these, 216 were of ESG1 and 49 schools of ESG2 (MEC, 2007). The ESG2 schools have the designation of *Complete Secondary Schools* because they offer all grades of secondary education, i.e., from Grades 8 to 12. The efficiency of the education system in general is extremely low and is characterised by high repetition and dropout rates. The system is also affected by significant disparities in gender and equity (MEC, 2007; Palme, 1992). For instance, with the exception of Maputo and surroundings, the enrolment rate for girls varies. In the transition from primary to secondary education and within the subsystem of secondary education (from ESG1 to ESG2) the system suffers a significant loss of girls. As per December 2006 the participation of girls in secondary education was estimated as 40.1% compared with 46.8% of primary. Within secondary education the figures of girls participation dropped from 42.2% in ESG1 to 38.9% in ESG2 (MEC, 2007).

In relation to teacher training the impact on the teaching profession has also been a matter of concern. A substantial percentage of graduates do not enter the teaching profession as they find jobs in the expanding market economy or in government ministries. From the total number of Pedagogical University (UP) secondary qualified teachers and those from other training institutions (mainly foreign) who are working in the public education sector, only about 30% are teaching in secondary schools (MinEd, 2004). Approximately 15% of those who enter UP are already serving as teachers. It is widely accepted that the four-year

course of *Licenciatura* is too long and academic for a qualification course. UP's strategic plan recognises that it will be unable to meet MEC projections for trained secondary teachers and that the overall shortfall will grow by about 60 teachers per year until 2008, when it will be 340 teachers. There are UP plans to increase the number of graduates in Mathematics, Portuguese, and Sciences, but this depends on sufficient qualified candidates with Grade 12 applying for the course. Although there are actually some promotion measures from MEC enabling some in-service teachers to enroll at UP without Grade 12, the number of the graduates for these fields is still insufficient.

As the number of schools expands, qualified teachers are becoming increasingly difficult to recruit. The number of unqualified teachers has increased more quickly and the number of qualified teachers has declined, especially outside Maputo. For example, in three schools in Tete Province with nearly 4500 students in total there are only three qualified teachers, while two schools in Maputo Province with nearly 2000 students have 35 qualified teachers. One in six teachers has no, or insufficient, teaching qualification. Men outnumber women in the secondary teaching profession by 5:1 and the increase in the numbers of unqualified teachers has maintained this imbalance. There are also differences in the availability of qualified teachers in different subjects. Estimates based on a representative sample of 1600 teachers suggest that less than 30% of teachers in English and Mathematics are qualified, with particular difficulties in recruiting teachers of Drawing. Female teachers are under-represented in the teaching of Biology, Chemistry, Mathematics, Physics and Drawing (37% of the total teachers is female).

In terms of retention of teachers, the situation can be characterised by a significant number of teachers who are leaving schools for better-paid employment (MEC, 2007). According to the Ministry of Education and Culture, a review of possible incentives is needed in the short term and should include: (i) improved living and working conditions, (ii) better contractual regulations, (iii) better career opportunities, (iv) access to credit, (v) accommodation close to the schools, and (vi) bursaries for their children. However, as teachers improve their educational background, they tend to find better paid work, thus teacher development has a potentially damaging side effect on the education system,

which needs to be countered in any review of the teacher development process. Some teachers, although qualified, remain on contract terms for up to two years waiting for their new position to be formally established. Many unqualified teachers are now being recruited on provisional contracts (seasonal teachers) after graduation from secondary school (end of Grade 12) and they need a system that will give them an opportunity to achieve the status of fully qualified teachers.

After this review of problems that the Mozambican education system, and especially secondary education, is confronted with, it is important to state that Mozambican teachers strive to meet the same learning outcomes for all students, at least for the secondary education graduates. One assumption underlying this research is that good assessment practices used by teachers in their classrooms can well serve as one of the means of realising these learning outcomes. It is believed that all teachers – whether they are qualified, under-qualified, unqualified, pre- and in-service teachers - can be made familiar with the characteristics and usefulness of formative assessment. The on-going review of the secondary education curriculum by the MEC has already identified the revision of the assessment practices as one of the strategic priority for the secondary education (MEC & INDE, 2007). The present study proposes an investigation aimed at improving teacher assessment practices at this level with the focus on Physics education in Grade 12. The research is of an exploratory nature involving a selected number of secondary school teachers.

1.2 Research problem and aims

All planned or unplanned assessments carried out by the teacher at school level, and the final examination undertaken by the MEC at a national level are governed by regulations set out in a document called "Regulation of Assessment for the General Secondary Education" published in the Bulletin of the Republic No. 35/96 of August 28, 1996 (*Governo de Moçambique, 1996*). This document presents an orientation on objectives, forms, frequency, methods as well as the approval criteria. Accordingly, the objectives of assessment are: (i) to verify the degree of the mastery of the curriculum objectives; (ii) to

contribute to the improvement of the teaching quality and to the evaluation of the teacher's work; and (iii) to verify the effectiveness of the methods and teaching/learning means.

A review of studies that took a close look at classroom assessment practices in general (albeit on primary level) indicates that there are some deviations from the application of the "Regulation of Assessment" document (INDE, 2005; Lauchande, 2001; MinEd, 1998; Palme, 1992; Popov, 1994). Specifically, the review revealed the following points:

- In general, the assessment is fundamentally based on the memorisation of concepts, formulas and mechanisation of procedures partly due to the teachers' weak scientific and pedagogic competence, and to their lack of skills in developing appropriate assessment instruments. This situation is more accentuated in experimental subjects, such as Physics, where teachers do not effectively assess the student abilities to manipulate, observe, generalise and establish relationships. This is due, on the one hand, to the teachers' weak preparation for assessing these abilities, and on the other hand, to the lack of teaching material and equipment such as microscopes and some other laboratory equipment.

- Students show great difficulties in providing correct answers to essay questions and their writing skills are below average.

- It is argued that the Regulation of Assessment is punishing students because it gives more emphasis on summative than formative assessment activities.

- The quality of teaching is very low. Teachers claim not to be involved in educational decision-making, and they have no opportunity to participate in regular upgrading courses.

- The teachers show lack of skills in designing and administering valid formative tests, i.e., tests that assess what is supposed to be assessed. There are also problems in how test items are formulated, especially those requiring analysis and comprehension levels of cognition.

- Tests and other assessment practices used by the teachers at the school level are not always in line with what is assessed by the national examinations.

- MEC does not always have access to reliable information about what really happens in classrooms.

5

All these problems relate to questions of how the intended curriculum – what teachers are expected to teach and students to learn - is implemented by teachers in their classrooms and is attained by students; how the learning process is monitored; and how students' achievement is assessed and certified in schools. In short, the problems relate to the need for improvement of formative and summative assessment in schools.

The argument for this study was that the improvement of teacher assessment strategies could help to monitor qualitative improvements of students' results and of the performance of the educational system as a whole. The central aim of this study was to investigate how the assessment practices of teachers can be improved, with a focus on Grade 12 Physics teachers. To address this aim, a twofold approach was applied. The core of the study was to investigate, through an intervention approach, the characteristics of effective assessment practices for Physics teachers. The intervention consisted of developing and trying out consecutive prototypes of assessment practices that Physics teachers may use in their classrooms. But, an important starting point for this was to have a good understanding of what was actually going on in the classroom. At the beginning of the research, a Baseline Survey was conducted in order to know what assessment practices Physics teachers were primarily undertaking.

So the main research question of this study was formulated as set out below.

What assessment practices do Grade 12 teachers in Physics in Mozambique apply and how can they be improved?

Available literature suggested that any improvement of assessment practices can only be an important means of improving teachers' work in the classroom if it is accompanied by changes in the instructional process (Airasian, 2001; Chatterji, 2003; Popham, 2002; van den Akker, 1999). For example, improved teachers' assessment strategies in Physics can use formative approaches as a way of improving student learning in the classroom. Assessment is important for the instructional process because (i) it determines whether

students are moving satisfactorily toward instructional outcomes that teachers are seeking to promote; and (ii) teachers can discern where to direct their instructional energies to ameliorate students' weaknesses and what already mastered skills or knowledge can be omitted from the lesson. Therefore, the importance of the study lies on the intervention phase where improved assessment strategies are developed, following both formative and summative assessment approaches.

Having addressed the main research question, the following section outlines the research approach of the study.

1.3 Research approach

The present study applied a twofold approach, namely a survey for the preliminary study, and an educational design research approach employed for the Intervention Study. A preliminary analysis of the Mozambican education system and a review of literature were undertaken leading to the conceptualisation of both the Baseline Survey and the Intervention Study. The findings of the Baseline Survey were used to further elaborate and refine the conceptual framework for the Intervention Study. The research designs for baseline and for intervention studies are elaborated on in Chapter 4. This subsection presents only a short characterisation of the two phases.

The Baseline Survey was aimed at getting an overall impression of the assessment practices used by Physics teachers in schools. A limited and purposeful sample of Grade 12 Physics teachers selected from different schools and provinces were considered to be sufficient to represent the different contexts (urban-rural, north-centre-south, etc.) of the country. This means that the survey sample was not based on a random selection from the population of all Grade 12 Physics teachers, but on a purposefully and carefully selected sample that provides for the indication of all aspects of Mozambican Grade 12 Physics education.

The Intervention Study aimed at producing improvements on teacher assessment practices. Its scientific position is rooted in the pragmatic knowledge claim (see Creswell,

2003). According to this claim, knowledge arises out of actions, situations, and consequences, where the main concern is with applications and solutions to problems. In principle, both qualitative and quantitative methods can be applied to collect and analyse data with the main aim of understanding the complexities of the current situation and to produce findings that contribute to the solution of the problem at stake. More importantly, the study approach was geared towards "what works" in schools and classrooms and how it will work on the basis of intended consequences. Within this framework, the Intervention Study applied an educational design research approach (see Bereiter, 2002; Plomp, 2006; Reeves, 2000; Richey et al., 2004; van den Akker, 1999). Educational design research in the context of this study is a research approach in which the search for characteristics of an effective intervention is conducted, while working on that intervention. Four phases can be distinguished in such an approach (Plomp, 2006): (i) preliminary research, (ii) prototyping phase, (iii) assessment phase, and (iv) systematic reflection and documentation.

For the purpose of this study, only two phases were considered namely: preliminary research and prototyping phase while systematic reflection and documentation took place throughout the study. The preliminary research phase of the Intervention Study built on the findings emerging from the literature review, document analysis, and the Baseline Survey leading to the conceptual framework and the operational research questions of the Intervention Study. The prototyping phase comprised iterative design with formative evaluation of several prototypes in a cyclical way applying a model with analysis-design-development-intervention-evaluation (ADDIE) elements. The emphasis of this phase was on refining and optimising the intervention by verifying whether the intervention met the prescribed design specifications. The systematic reflection and documentation phase portrayed the entire study (both baseline and intervention phases) in order to support a retrospective analysis and the specification of design principles. Specifically, all undertaken activities and the emerging findings of the two phases were used to draw inferences and to formulate design principles on how assessment practices in Mozambican Grade 12 Physics classrooms can be improved. The study did not consider the assessment phase that comprises a summative evaluation of whether the intervention works in

classrooms and with teachers who were not part of the prototyping phase. The reason for the exclusion of this phase is the limitation of time.

A research model adapted from Verschuren and Doorewaard (2003, taken from Plomp, 2004) influenced the structure of this study. The model is a schematic representation of the research goal and the general steps needed to achieve this goal (Figure 1.1). This model emphasises that a research framework can be developed step by step and it distinguishes four distinctive steps, which are worked through in reverse order whilst doing the research. The first step (A) is the summary of the research goal where, depending on the research question, new theories, principles and/or hypotheses are formulated (to be tested or developed in the research), or a problem context is diagnosed and an intervention is suggested. The second (B) and third (C) steps are the identification of the research object and research perspective respectively. The fourth step (D) corresponds to a number of research activities to be undertaken in order to investigate the problem and to generate a solution to the problem.
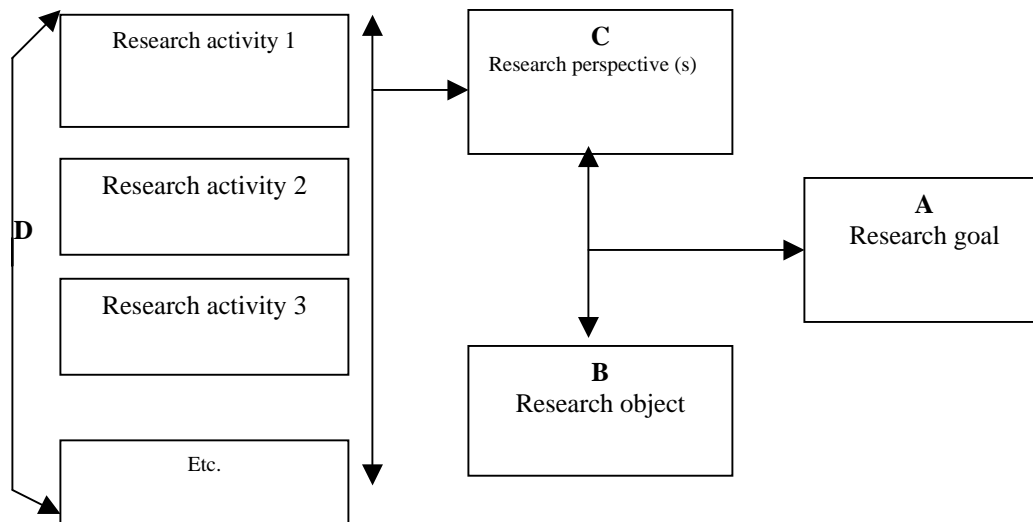

(Source: Plomp, 2004 adapted from Verschuren & Doorewaard, 2003)

Figure 1.1: Steps towards achieving a research goal

Although the original model of Verschuren and Doorewaard clearly depicts steps to be followed to achieve any research goals and the corresponding research activities, the

model indicates neither causality nor possible relationships between the elements in the model.
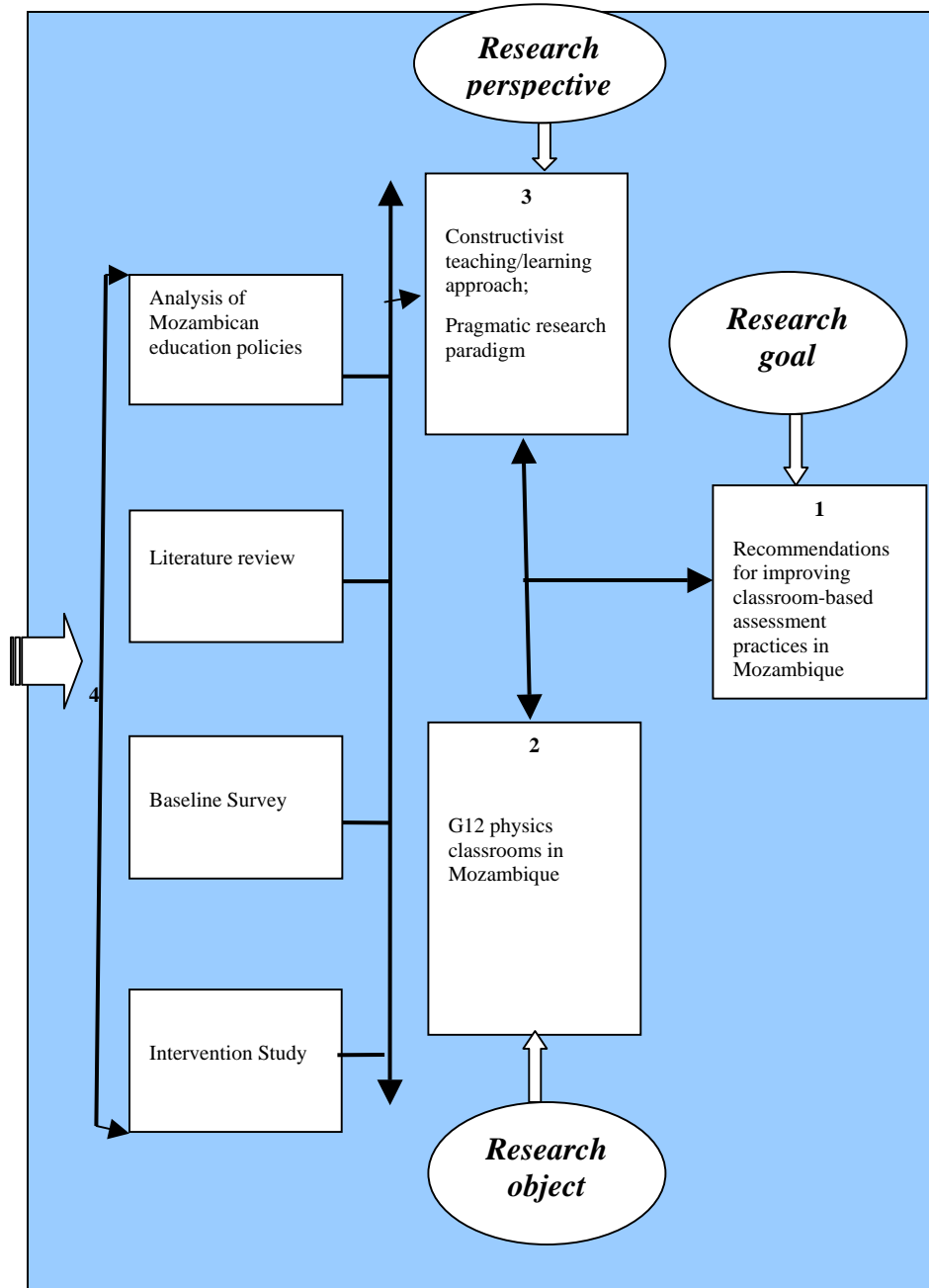
Figure 1.2: Research model of the study

The model for this study (Figure 1.2) presents the study process in terms of research goal, research object, research perspective, and context analysis and intervention. In the model, the research goal (1) is defined as the formulation of 'recommendations for improving classroom-based assessment practices in Mozambique'. It is assumed that undertaking an Intervention Study, aimed at helping teachers to design and carry out some selected performance assessment practices in Physics would improve their classroom practices in

general and would result in a number of design principles for designing such assessment practices. The research object (2) refers to the assessments practices that 'Grade 12 Physics teachers apply in the classroom'. The practices can be either formal or informal, with the focus on the formative type of assessments. As is the case with any other problem, to achieve relevant, suitable and applicable solutions to educational problems a triangulation is applied to ensure that the various problems' perspectives are seen from more than one angle at the same time. In Section 1.1 it was mentioned that the Mozambican education system, in general, is confronted with problems related to the lack of familiarity of both teachers and students with the characteristics and usefulness of formative assessment. To focus this study, Grade 12 and the subject Physics were chosen as the means of studying how to improve classroom assessment practices. This step is further elaborated in Chapter 2, where the context of Mozambican education is discussed. The research perspective (3) depicts the lens through which the researcher can look at the research object under investigation. In this study, this perspective refers to the 'constructivist approach of learning and teaching' as the context within which the classroom-based assessments are investigated by helping Grade 12 students to perform authentic tasks with the aim of solving real-life problems. This is in line with the Mozambique government policy for the revised curriculum that advocates a constructivist approach with strong emphasis on authentic assessment. The research perspective also includes the application of a pragmatic research approach, according to which the emphasis is on what works at the time of the intervention and how to research on the basis of intended outcomes. This step is further elaborated in Chapter 3 (Section 3.4) as findings from literature review on contextualising assessment practices in Physics. The context analysis and the Intervention Study (4) consist of a number of steps: the 'analysis of Mozambican educational policies' regarding assessment, the 'literature review', i.e., the summary of other research and arguments of other scholars on the issue, the 'Baseline Survey' of the actual status of classroom-based assessment in Grade 12 Physics in Mozambique, and the 'Intervention Study' aimed at improving teachers' assessments in schools. This step is further elaborated in Chapters 2 and 3 (document analysis and literature review) and in Chapters 5 and 6 (findings from baseline and intervention phases).

The research model in Figure 1.2 serves as an important conceptual guide for the steps necessary to follow in order to analyze assessment practices applied by secondary school Physics teachers in Mozambique, and the way to improve these. As the information is gathered and improvements are suggested, the model provides a guide to help in exploring the relationships between the learning and the assessment of Physics.

1.4 Overview of the following chapters

This dissertation is organised into seven chapters. This chapter provides an introduction to the problem and how to address this problem. The overview of the Mozambique context, and the problem viewed in its educational context particularly in relation to teacher qualifications are presented in Chapter 2. The review of the literature resulting in a conceptual framework for the research is set out in Chapter 3. This chapter includes reviews of the publications and research done internationally, which are used to support the choices of the research methods and to address what other scholars have written about the topic. Chapter 4 discusses the research design, and the research procedures chosen for the baseline and intervention phases of the study. The findings from the Baseline Survey are reported in Chapter 5. Chapter 6 reports on the outcomes of the Intervention Study. The development and try out of the various prototypes as well as their expected practicality and expected effectiveness in the classroom setting are all discussed in this chapter. Chapter 7 presents the conclusions in the light of the research question, discusses the findings, and presents a number of recommendations.

CHAPTER 2

THE CONTEXT OF THE STUDY

CHAPTER 2

THE CONTEXT OF THE STUDY

This chapter outlines the situation prevailing in secondary education in Mozambique within the overall education system. It starts by presenting the geographical, political, and socio-economic status of the country (Section 2.1). Section 2.2 discusses the current education context, focusing on assessment system and practices, curriculum reform, and the importance of linking curriculum, instruction, and assessment. The conceptualisation and rationale of the problem are described in Section 2.3. Finally, Section 2.4 discusses the importance of the study for the Mozambican context.

2.1 Country background information

Mozambique, with an area of 799,380 Km², is located on the eastern coast of Southern Africa south of the equator. It is bordered by Tanzania in the north, Malawi and Zambia in the north-west, Zimbabwe in the west, South Africa and Swaziland in the south-east, and also by South Africa in the south. The eastern part consists of nearly a 2,500 Km coastline facing the Indian Ocean. Data from the National Institute of Statistics (INE, 2007) indicate that the total population of the country is 20.500 million inhabitants. About 56.7% of the population is illiterate.

Figure 2.1: Internal borders of Mozambique and its provinces

The country's internal borders are defined by eleven provinces, namely Cabo Delgado, Gaza, Inhambane, Manica, Maputo City, Maputo Province, Nampula, Niassa, Sofala, Tete, and Zambezia. The most populous provinces are Nampula (20% of the national population) and Zambezia (19%). The official language of the country is Portuguese. Sixteen local languages are spoken throughout the country and of these Emakhuwa (26.3%), Xichangana (11.4%), Elomwe (7.9%), and Cisena (7.0%) are the most spoken (INE, 2007). In terms of health conditions, the country is characterised by a diverse distribution of health units. Data from the Ministry of Health, quoted in the Statistical Yearbook (2003), indicate that in 2003 about 53.3% of the country is covered by health posts, 43.1% by health centres, and 3.6% by hospitals. Table 2.1 summarises the country's political, social, and economic situation.

Table 2.1: Mozambique profile

The country	Area of 799,390km²; date of independence: 25 June 1975. The annual average temperature is 23.8ºC. The minimum temperature absolute is 6.8ºC and the maximum absolute temperature is 45.3ºC.
Government	Armando Emilio Guebuza has been the president since February 2005. Mozambique is a Republic and adopted a new constitution in 2005. The parliament consists of 250 members. FRELIMO is the political party in power and the biggest.
Capital city	Maputo, with 1,162 000 inhabitants in 2003.
The people	Mozambique has a population of 20.5 million inhabitants. In 2003 the illiteracy rate was 53.6 and life expectancy at birth was 46.3. The population is densest in the North and along the coast with Indian Ocean.
Currency	The country's own currency is METICAL (MZM). 1 US dollar is equivalent to 24,800 MZM (per August 2005).
Languages	The official language is Portuguese. Sixteen local languages are spoken throughout the country with Emakhuwa (26.3%), Xichangana (11.4%), Elomwe (7.9%), and Cisena (7.0%) being the most widely spoken.
Education	The enrolment rates by 2004 for general secondary education were 107,301 students: 95,201 students in ESG1 and 12,100 students in ESG2. There are 143 public schools from which 27 are of ESG2.
Economy	The human development index in 2002 was 0.354. The adjusted real GDP per capita was 0.360 (UNDP, 2004). Agriculture is the basis of the economy. In 2003 the main export products were cashew nuts, prawns, lobsters, cotton, and wood. Import products are transport and electrical equipment, machinery, vegetable and petroleum products and cereals.

The following section discusses the current situation in education with the main focus being on assessment practices, curriculum reform, and the importance of linking curriculum, instruction and assessment.

2.2 Educational context

The Mozambican Education Policy defines the provision of education to the population as its main goal while trying to ensure acceptable standards of teaching quality. Secondary education is regarded as an integral component of social and economic development. It

provides essential preparation for mid-level employment and post-secondary education and training, including training for teachers, creating the practical skills that will facilitate rapid integration into society, particularly into the employment market. In line with the Government's objectives, the secondary education sub-sector pursues limited expansion in enrolments, aimed at raising minimum quality standards with a focus on increasing equity in access, particularly for girls and other disadvantaged groups. On the other hand, the sub-sector strives to improve the quality of instruction by equipping schools, investing in teacher training and qualification, providing pedagogical support and supervision, reforming the curriculum, and ensuring the provision of teaching and learning materials. The current situation shows that there is great pressure for an expansion of the secondary education. Increasing numbers of students finish their primary education and are willing to continue their education in the system. The present situation of the secondary education is characterised by low efficiency, high repetition rates with an average of 35% in the ESG1 and 25% in the ESG2, high failure rates and low performance of teachers (MEC&INDE, 2007). There are also huge disparities in the provinces. Despite the fact that community, private and religious schools offer alternative opportunities to some children, their contribution is still insignificant in regard to the improvement of access to the ESG and to the reduction of geographic and gender disparities. The majority of children from poor social groups, particularly from rural areas, do not have access to secondary education and there are significant geographic (North, Centre, South, and rural vs urban) and gender disparities (MEC, 2007).

2.2.1 Assessment system and practices

The Regulation of Assessment for the General Secondary Education document of the MEC highlights two main functions of assessment, namely a formative and a summative function. The formative function, integrating continuous and diagnostic functions, is aimed at undertaking a systematic analysis of the students' results and the reasons for these results. The summative function is orientated towards assessing the level of performance of students and the attribution of a final classification. At the end of the year students obtain a final mark for each subject. This is a pass mark when the student has

equal to, or greater than, 10 out of 20 points and a fail mark when it is less than 10. Most importantly, if a student fails the two core subjects Portuguese or Mathematics s/he cannot transfer to the following grade. Transition from Grade 11 to Grade 12 will take place if a student has (i) a pass mark for Portuguese and Mathematics, and (ii) not more than two fail marks in total. Regarding assessment procedures for teachers in general, the MEC document indicates that, at classroom level, the assessment system consists of three main forms: (i) Activities of Systematic Control (ACS), (ii) Activities of Partial Control (ACP) and (iii) Exams. The ACS and ACP are teacher-made assessments and are undertaken in every grades (from 8 to 12), while the exams are prepared by MEC and only administered at the end of grades 10 and 12 for certification and placement purposes. ACS is meant to be a formative assessment and is to be applied by a teacher to assess parts of a unit of the syllabus. Assessment methods can be:

- oral;
- written, with prior announcement, with a maximum duration of 45 minutes;
- written, without previous announcement, on the theme of the previous lesson or on the homework, with a maximum duration of fifteen minutes;
- homework;
- practical laboratory activities or of another type;
- verification of the student's exercise books;
- activities on selected themes in several units of the syllabus; or
- other activities designed to prove the student's performance in part of a unit.

ACP has a more summative character, as it is meant to assess student performance in the units of the teaching programs. Methods of assessment can be:

- written, with maximum duration of 90 minutes;
- practical activities; or
- research activities.

The examinations are prepared by the Ministry to assess students' knowledge, abilities, and attitudes developed in the education process of each cycle. They can be written or oral depending on the nature of the subject. The written examinations at the end of Grade 12

are the same nationally for all students and schools (public and private) of the same level. The national examinations of all subjects (including Physics) are centrally developed and distributed by the MEC through the Provincial Directorates of Education and Culture. In the MEC, multidisciplinary groups of officials from the National Directorate of General Education (DINEG) develop four exam proposals for each subject, taking into consideration teacher proposals. The teachers who submit proposals are carefully selected from schools. The exam proposals are then sent to the National Council of Exams, Certification and Equivalence (CNECE), a unit responsible for examinations and level certifications within the MEC. This department is then responsible for the analysis and approval of the submitted proposals and for the final selection of the exam papers. The examinations are administered in each school by the school's Commission of Teachers, and are graded by the same Commission. Provincial and district inspectors are sent to schools to monitor the whole process, in particular to control whether the scoring guides previously prepared with the exam papers are correctly followed. Concerning the number of written tests during the school year the situation is as follows:

In the Cycle 2 (Grades 10 to 12) the number of ACP per semester is three for all subjects. As for ACS, the teacher may administer as many tests as s/he wants, but three assessments should be registered. The student grades are based on the 0-20 points scale. The semester and the yearly mean are calculated according to the formulae (rounded) set out below.

Table 2.2: Formulae for calculating student marks

1. Semester Mean: $\dfrac{\text{Mean of ACS} + 2x \text{ Mean of ACP}}{3}$

2. Yearly Mean: $\dfrac{\text{Mean of the 1st semester} + \text{Mean of the 2nd semester}}{2}$

3. Final Mark (G12): $\dfrac{2x \text{ Yearly Mean} + \text{Exam Mark}}{3}$

In the case of the Languages, the exam mark is obtained in the following way:

Exam Mark: $\dfrac{\text{Mark of the Written Exam} + \text{Mark of the Oral Exam}}{2}$

ACP = Activities of Partial Control, ACS = Activities of Systematic Control, G12 = Grade 12

Annually, schools should send, before a date previously set, the statistical data of the examinations to the CNECE in the MEC, after having completed the grading of the examinations.

2.2.2 Curriculum review and reform

The MEC's general policy for secondary education is well outlined in the Secondary Education and Secondary Teacher Education Strategic Plan document (MinEd, 2001). In terms of the secondary school curriculum, the document indicates, on the one hand, that the present curriculum is characterised by an excessive number of subjects. The ESG1 curriculum has eleven subjects, and ESG2 has three streams of seven subjects each. Life skills do not feature sufficiently in the curriculum of either ESG1 or ESG2. One of the consequences of this situation has been high repetition and dropout rates, especially in the early years of ESG1 (Palme, 1992). Students in ESG2 tend to choose social studies, perceiving it to be easier. In summary, the current ESG2 curriculum is extremely academic and demands a high level of theoretical knowledge, without promoting practical skills that would facilitate the integration of graduates into the labour market. This diminishes the possibility of developing a critical mass of mathematic and Science students, and is subsequently reflected in the number of new entries to university, particularly of girls. The present curriculum, particularly in ESG2 serves the secondary education by selecting students for post-secondary education. Competencies in languages are very influential in the educational system. While a competency in the Portuguese language is a determining factor in tests and examination results, the demands of globalization and rapid economy growth mean that the employers attach demand in English competency even greater than few years earlier. There is little gender visibility in the curriculum – across subjects, in extra-curricular activities, and in the preparation of instructional materials. The curriculum and the assessment of student learning levels are crucial to educational provision. But curriculum issues are inextricably related to the major policy issue of the purpose of secondary education. Curriculum changes can affect the number of teachers needed in each subject, and considerations related to the size and

nature of secondary education (formal schools and open and distance education). The Ministry of Education and Culture recognises that, to achieve effective results, a co-ordinated curriculum and assessment strategy needs to be designed.

Regarding the external efficiency of the system the government recognises that there is a need for much more study on the issue of the relevance of the curriculum to the world of work. On the one hand, reports (MEC & INDE, 2007; MinEd, 1998; MinEd, 2001) state that there will be a critical shortage of workforce to sustain and improve economic progress in Mozambique; on the other, there are indications of comparatively high levels of unemployment among educated workforce. There is a need to produce secondary level graduates to ensure an adequate supply of teachers and other public servants (in the health and extension agriculture services). Current educational thinking is that a good general, flexible secondary education is needed, as the future job market is uncertain and subject to rapid technological change.

The assessment system, particularly the examinations, is seen to be potentially vulnerable and characterised by inefficiencies and a low level of control, which results in high rates of repetition and dropouts, particularly in the early classes of secondary education. Therefore, the MEC is conscious that the system of assessments and examinations is in need of major overhaul and this can only be achieved as part of the secondary education curriculum reform (MEC & INDE, 2007; MinEd, 2001). Summative assessment at the secondary level is mentioned in the MinEd document as being one of the key components in monitoring the quality of secondary education. This type of assessment refers to ACP and normally takes place at the end of a learning period, usually consisting of three main tests that are written at the end of programme units, and aims to determine how much of the content of the subject the students know.

The most pressing issue is the steady increase of unqualified teachers in schools, which indicates two urgent, related concerns: On one hand the importance of considering the needs of teachers (both qualified and unqualified) should be taken into account seriously, and on the other there is the need for a qualification programme for those teachers.

Although there are some in-service training initiatives (e.g., by Eduardo Mondlane University, Distance Education Unit under the MEC), UP should reconsider its courses to improve the impact. There are indications that UP is developing a strategic plan which includes a move to establish the three-year course as a basic teacher qualification for teachers of all subjects. It is expected that successful graduates would then be able to apply for postgraduate study through a one to two year Master's Degree. These are, however, long-term plans with long-term expected results. More urgent action should be taken, especially with those teachers working in the classrooms today.

Currently the MEC is working on a curriculum revision for secondary education to be implemented soon (as at August 2007). According to official documents available in the MEC (INDE, 2005; MEC & INDE, 2007; MEC, 2007; MinEd, 1998; MinEd, 2001) the strategic priority for secondary education is the revision of the curriculum aimed at incorporating less of an academic (theoretical) and more of a practical orientation; the revision of the assessment practices and the student learning outcomes; and the expansion of the in-service training opportunities for secondary school teachers. An example of a measure aimed at improvement included in the draft documents is that teachers must be made familiar with the characteristics and usefulness of formative assessment (INDE, 2005; MEC & INDE, 2007). Teachers will have to learn how to develop formative assessments that will be used in the classroom to inform and enhance the learning process.

2.2.3 Importance of linking curriculum, instruction, and assessment

To address the problems mentioned above, it is important that in the revised curriculum, curriculum (what should be taught), instruction (what is being taught and how), and assessment (assessing student learning) are linked. This is reflected in Popham's position (2002), when he states that assessment in the classroom is central to student learning. Firstly, it determines whether students are moving satisfactorily toward instructional outcomes that the teacher and the educational system through the national curriculum are seeking to promote. Secondly, assessment is important for the instructional process because teachers can discern (i) where to put direct instructional energies to ameliorate

student weaknesses and (ii) what already mastered skills or knowledge can be instructionally avoided. These functions of assessment illustrate the importance of the linkage between curriculum, instruction and assessment and the crucial role played by teachers in making this connection work effectively. Although teachers have shown difficulties in adapting to a student-centred approach of instruction due to the 'tradition' in Mozambican education and the characteristics of the system during their training, which advocated a more teacher-centred approach, the present MEC policy recommends a more constructivist and student-centred approach.

It is the author's perception that improvement of teacher assessment practices, both formative and summative, could help monitor improvements in the quality of students' results and the performance of the educational system, and achieve the intended learning outcomes.

It has been argued that one of the major challenges facing curriculum improvement is creating a balance and consistency between the various components of a curriculum (refer to Chapter 4, subsection 4.3.2). These components may range from aims and objectives of learning, content, learning activities, teacher role, materials and resources, grouping, location, time, to assessment. However, the choice of focusing in this study on improvement of the assessment component is based on the conviction that this component deserves separate attention at all levels. But the other components of the curriculum and the process of instruction have not been neglected because a careful alignment between assessment and these aspects is critical for any successful curriculum change. Furthermore, the improvement of assessment practices can easily raise learning standards (Weeden, Winter & Broadfoot, 2002).

Section 2.2 above has provided the educational background of the study. The following section addresses the conceptualization and rationale of the problem.

2.3 Conceptualisation and rationale of the problem

It is against the background of poor student results and the lack of effectiveness of present assessment practices in schools, as described in previous section, that this study aims at investigating formative and summative assessment practices in Physics teaching in Grade 12, and at developing an intervention aimed at improving the assessment practices for Physics in ESG2. The problem is perceived as a problem at school level. Before elaborating on the problem, first the environment of the school is considered as far as it may have an influence on the problem area (see Figure 2.2).
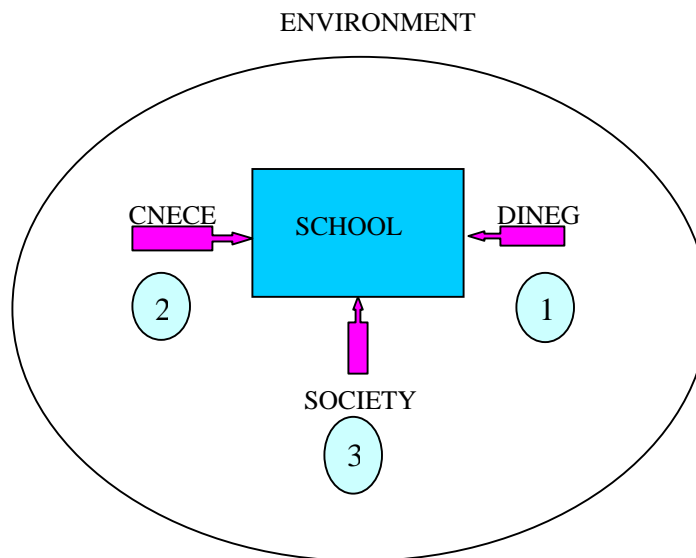
ENVIRONMENT

Figure 2.2: Elements of the school environment

Three institutions are crucial when taking into consideration the educational environment of the school.

① DINEG: National Directorate of General Education – this is a unit in the Ministry of Education and Culture with responsibility for the coordination of the curriculum review process for the secondary schools. It also has a role in supervising schools but it has no direct influence on teaching and learning processes.

② CNECE: National Council of Exams, Certification and Equivalence – this is a unit within the Ministry responsible for setting the goals, objectives and standards of assessment by

the examinations in schools. The unit is also responsible for certifying students' credentials. Therefore, this unit determines to a large extent the focus of classroom assessment practices.
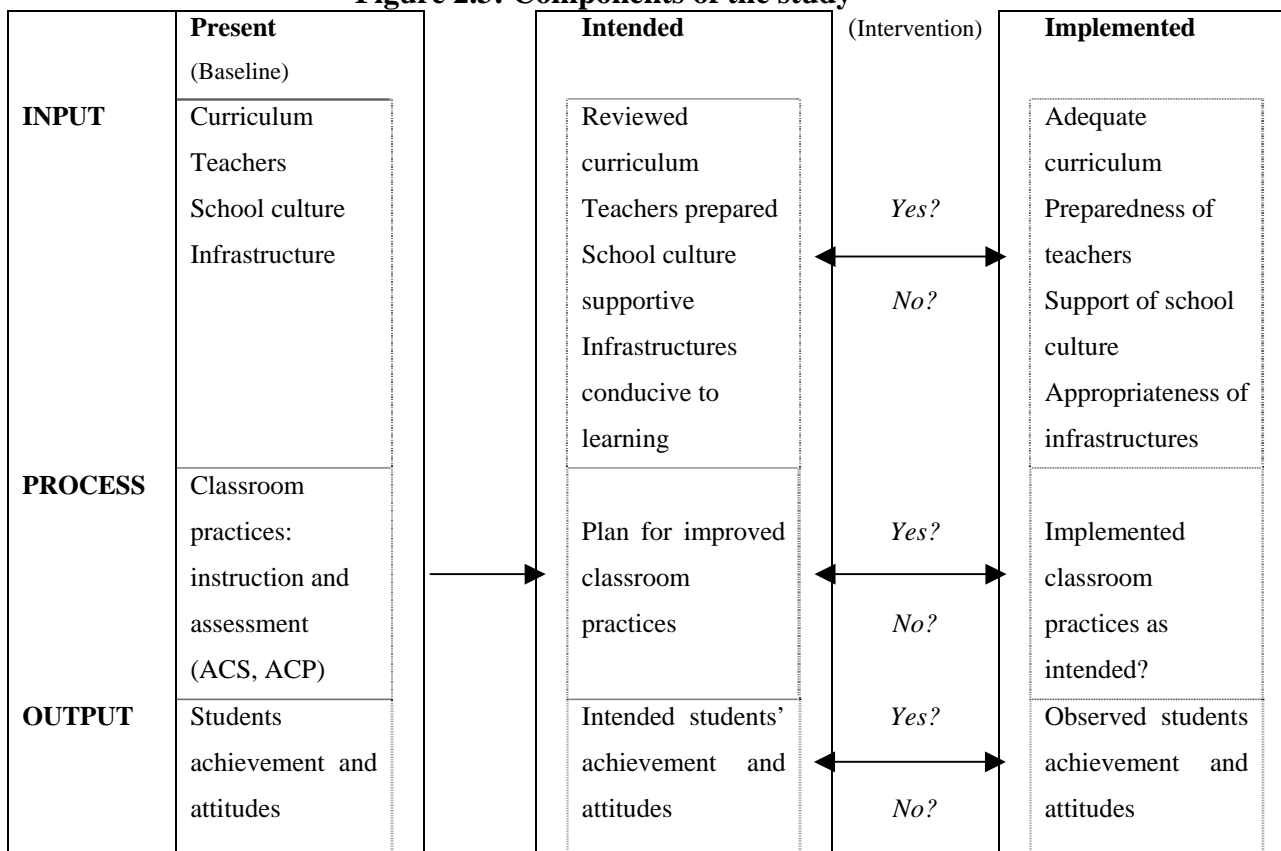
3 Society: (non-) academic community, employers, and donors - this entity encompasses parents, higher education, employers, NGO's and non-profit organisations who play a role in school problem awareness and who expect that schools meet the educational expectations of the society.

All these entities together establish the context for the schools and they have 'external' influences on the school. They have a particular interest in school results and may influence, in one way or another, the course of the study. Therefore one constantly needs to be alert about their possible influence on the problem under investigation.

It is essential to have a good understanding of the present assessment practices in schools and classrooms in order to design an effective 'intervention in assessment'. This implies that the present study should include a Baseline Survey to develop a good understanding of the research problem prior to the Intervention Study of this research. The two parts are reflected in Figure 2.3.

Figure 2.3: Components of the study

	Present (Baseline)	Intended	(Intervention)	Implemented
INPUT	Curriculum Teachers School culture Infrastructure	Reviewed curriculum Teachers prepared School culture supportive Infrastructures conducive to learning	Yes? ⟷ No?	Adequate curriculum Preparedness of teachers Support of school culture Appropriateness of infrastructures
PROCESS	Classroom practices: instruction and assessment (ACS, ACP)	Plan for improved classroom practices	Yes? ⟷ No?	Implemented classroom practices as intended?
OUTPUT	Students achievement and attitudes	Intended students' achievement and attitudes	Yes? ⟷ No?	Observed students achievement and attitudes

The school and classroom practices are looked at from an input-process-output (IPO) model. The model categories were derived from Howie (2002) and Shavelson et al., (1987) and are broadly considered. In later stages, they will be refined on the basis of the literature review and other research activities.

Although one has to acknowledge that the school environment does have influence on the school, for instance by setting policies and regulations for the school, this research focuses on processes within the school and will accept policies and regulations as setting the boundaries for what is possible in the schools. In other words, the research focuses on the level of the school, the *meso* level. In the IPO model for the problem being studied, the stakeholders are therefore:

a) the students as the subjects who need feedback to monitor their own learning;

b) the teachers who need the achievement and performance data for providing feedback to students and for themselves on the improvement of their instructional and assessment practices; and

c) the leadership in the school who has to arrange for the necessary conditions to make the intervention happen, such as school policy changes (if necessary), facilitating staff development and providing infrastructures.

Given the aims of the study, it is necessary to consider the IPO model for three different situations reflecting the different aspects of the problem which are discussed below.

1. The 'Present' is aimed at gathering baseline information on the conditions in place allowing that the current teachers' classroom practices take place, which finally lead to students' results. At the input level, there are: the present curriculum (under review), the teachers, the school culture, and the infrastructure as the environment, setting the boundaries of the instructional processes. At the process level, there are the classroom practices, comprising instructional processes and assessments (ACS and ACP) as the activities to be primarily investigated by the study. At the output level, there are the students' achievement and attitudes towards their learning of Physics.

2. The 'Intended' consists of a plan for improved classroom practices based on state-of-the-art literature and a thorough understanding of the present situation provided that, if the desired conditions (reviewed curriculum, teachers prepared, school culture supportive, infrastructures conducive to learning) are in place, the intended students' achievement and attitudes will be attained.

3. The 'Implemented' is the study of the actual implementation of the intervention developed under 'Intended'. Data were collected to find out whether classroom practices, including the desired input conditions and students' achievement and attitudes, were implemented as intended.

2.4 Importance of the study

Within this conceptualisation, the importance of this study for Mozambican context can be summarised as set out below.

Firstly, the improvement of assessment practices could help to monitor qualitative improvements in student results and of the performance of the educational system. It is expected that the assessment practices being investigated by this study will be an important means of improving teacher assessment practices, and must necessarily be accompanied by changes in the instructional process. For example, effective assessment prototypes for Physics can use formative and summative approaches as means to contribute to improving student learning in the classroom. The students and the teachers are therefore considered to be the prime beneficiaries of the study. Teachers need the data for providing feedback to students and for themselves and the students are the subjects who most need the data for monitoring their own knowledge. Implementing new strategies is always a difficult task to accomplish. Therefore, the study results also provide a framework as to how to support teachers in making the new assessment approaches more relevant for their classroom practices.

Secondly, good mastery of Physics and good final results in Physics are important for students themselves because of the implications related to the policy dealing with grade-to-grade promotion. Furthermore, good results are part of the high school diploma, which is a gateway to the university level. For the teachers, school results not only help them to take decisions on what instructional objectives to pursue but, as Popham (2002:11) puts it, "the results influence public perceptions of school effectiveness and respond to the pressures from above".

Thirdly, the improvement of teacher assessment practices by developing prototypes can serve as a supporting tool for the Ministry in monitoring the quality of education. The MEC has to rely on assessment data as indicators of the performance of the system. Furthermore, the improvement in student results is also important for the MEC in particular and for the society in general. For the Ministry, these results are used as

indicators of how well the system is performing. For society (donors, employers, and (non-) academic community), good results make the financial contribution to education noteworthy and, more generally, success in school signifies order and control. It evokes a traditional set of educational, social, economic, and moral values.

Finally, the study is a contribution to the research in Mozambique, particularly in terms of secondary education where studies of this nature are still scarce compared to those dealing with primary education. The combination of studies at both levels will enable decision-makers to plan adequately and to monitor the performance and quality of the education system as a whole.