CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS


This chapter summarizes the main findings of the research and seeks to answer the research questions, posed in chapter one. It also attempts to find out the extent to which the aims of the study were attained.

Based on the findings and conclusions of the study, recommendations are to be given to the Mozambican educational authorities.

First question: **What are teachers’ and learners’ opinions about the aims of practical work, as well as the microchemistry kits?**

Teachers and learners see the lack of practical work as one of the critical problems in the teaching and learning of chemistry. They also identified practical work as the single most popular option for enhancing the teaching and learning of chemistry in Mozambique.

Both teachers and learners assume that the reason for doing practical work is to support theory or to link theory with practices. This aim of practical work is similar to that adopted in the early stages of the development of practical work (±1850s to 1950s) (Woolnough and Allsop, 1985; Gott & Mashiter, 1991).

After using the microchemistry kits, teachers’ opinions were that they contributed mostly to learner motivation and interest in chemistry as well as to the development of manipulative skills. They also maintained that the microchemistry kits improved conceptual understanding; however, the development of scientific inquiry skills was not observable. This reflects the nature of the worksheets provided.
Both the learners and the teachers reported that learners enjoyed the experiments conducted with the microchemistry kits, mainly because they had a ‘feel of the phenomena’ (Woolnough & Allsop, 1985). Both teachers and learners suggested that (1) the microchemistry kits should be used on a regular basis in the teaching of chemistry and that (2) other schools and learners who did not use them should be given the opportunity to do so too.

Second question: *How does practical work contribute to conceptual understanding of chemistry content?*

An analysis of the results of the diagnostic test shows that there was a significant improvement in results from the pre-test to the post-test, especially in the experimental group, with regard to the questions which required conceptual understanding as well as the laboratory-based knowledge which did not require application of knowledge and use of scientific inquiry. From this one may conclude that using the microchemistry kits contributed to the conceptual understanding of the learners and that they caused an improvement in achievement on the laboratory-based questions of the diagnostic test.

Third question: *How does practical work contribute to improving learners’ motivation towards chemistry?*

As a result of the analysis of (1) the results of learners’ and teachers’ questionnaires, (2) classroom observations and (3) informal interviews with the teachers who used the microchemistry kits it was inferred that the use of the microchemistry kits increased the motivation of the learners towards chemistry. For example, they arrived at class on time; they were more committed in doing homework and become more inquisitive when engaged in chemistry content related to the phenomena observed during the practical work.

The most noteworthy comment from the learners regarding this question was to that some of them were thinking of pursuing chemistry or science related careers or being a scientist. These opinions are corroborated by teachers’ comments
about how the microscience kits contributed to increase learners’ motivation and interest towards chemistry lessons and chemistry in general.

This increase of learners’ motivation can be attributed to some of the features of microchemistry kits. For instance, learners reported in the post-intervention questionnaire, that the kits were easy to handle (almost without any special explanation from the teacher) and that their use of them in the classroom setting on the desks created a remarkable impression on the users. This was also observed during the practical work sessions.

Based on the experience of using microchemistry kits during the eight weeks of intervention three main conclusions can be inferred:

1. There is positive evidence that using microchemistry kits was beneficial for chemistry teaching and learning.

2. For maximum impact of the microchemistry kits the teacher has a crucial role, and by implication teacher’s preparation is very important if the kits are to be used effectively.

3. A physical facility, such as laboratory, by itself is not crucial if microchemistry kits are provided. For instance, in school C where there was no laboratory and experiments were performed in the classroom, learners performed better than in school D, with a conventional laboratory, in some of the categories of questions.

6.2. Recommendations.

Taking into consideration the findings and conclusions of the research it is possible to put forward two main recommendations to the Mozambican educational authorities and/or other institutions involved in the educational processes of the country.
Firstly, based on the acceptance of microchemistry kits by the learners and teachers, and the increase of learners’ motivation towards chemistry, it is recommended that the microchemistry kits be introduced in Mozambique, both in schools with laboratories and schools without laboratories. If they are to be introduced in Mozambique, the teachers should be trained and always reminded that their preparation is very important if the kits are to be used effectively.

Secondly, it is recommended that other studies be carried out in parallel with wider implementation, in order to find out the most effective ways of implementing microchemistry kits in Mozambican schools. These should include schools characterized by: large numbers of learners per class, teacher-centred approaches and a long term period without practical work. The studies should be based on the new curriculum and incorporate elements of constructivism, such as, learner-centredness, problem-solving and context-based approaches, these are issues referred to both in the policy documents and in the new programme for junior secondary school chemistry.

The Ministry of Education policy document, the Strategic Plan for Education in Mozambique (2004-2008) acknowledges the importance of the practical work and the investment required when it states:

“Some additional expenses cannot be avoided in secondary schools. The government will continue to invest in the rehabilitation and construction of essential infrastructures such as libraries and laboratories in the schools where they do not exist.” (Ministry of Education, 2003, p.33).

This statement is a clear acknowledgement of the reality of the majority of Mozambican schools, and is also a commitment to change the situation of science education in the country.
This acknowledgement is also in line with the priority given to practical work in chemistry teaching in the introduction of chemistry programs for the junior secondary schools:

“In each lesson the teacher must do as many of the experiments recommended in the program as possible and other experiments which the teacher decides to do. This will allow deep and solid acquisition of the content and at the same time can awaken learners’ interest for chemistry.” (Ministry of Education, 2004, p. 5).

The two issues presented above can be used as the rationale for the implementation of the microchemistry in Mozambique.