CHAPTER FIVE

SUMMARY OF FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

This study was prompted by the researcher's observation that in-service workshops organized by the department of education for training in the implementation of curriculum 2005 focuses mainly on terminology and practical activities and pays little attention to teaching methods referred to in the workshops. For example, although mention is made of cooperative learning and science process skills, these issues are not dealt with adequately in the workshops. As such the researcher set out to investigate the relationship between cooperative learning and science process skills.

Two schools were used to collect data that informed the investigation. The two schools used are in the Northern Province, South Africa and are located in rural disadvantaged communities. Cooperative learning was implemented in the two classes and an evaluation was made to determine whether achievement in science process skills improved or not.

The investigation is reported in this dissertation in the following structure (form). Chapter one outlined the background of the problem, research questions, motivation for the study, hypotheses, aims of the research, demarcations and limitations, definitions of concepts, and the programme of the research.

Chapter two gave a literature review on cooperative learning and science process skill. In particular the review focused on the Group Investigation method of cooperative learning and the Jigsaw method of cooperative learning on the development of learners' science process skills of observation, controlling variables, graphing and experimenting.

Chapter three outlined the description of the research design and the method of investigation. Chapter four presented the analysis and interpretation of results. Descriptive statistics (frequencies) were used to answer the research questions while the Wilcoxon signed ranked test was used to test the null hypotheses.

In this concluding chapter the following aspects will be considered:

- The findings from the literature study regarding the Jigsaw and Group investigation methods of cooperative learning as well as the four science process skills investigated in this study.

- The results of the empirical study will be discussed and assessed.

- Limitations of this study.

- Recommendations for further research will be suggested.

5.2 SUMMARY OF THE LITERATURE REVIEW

5.2.1 Findings regarding cooperative learning

Since the implementation of curriculum 2005, many teachers have come to know about cooperative learning. This method of teaching has been mentioned in staff rooms and official department of education documents countless times. On closer scrutiny though, teachers the researcher spoke to did not seem to know exactly what and how this teaching method should be applied.

The literature review indicated that cooperative learning is a method where a group of learners pursue academic goals through collaborative efforts. This method has been found to encourage cooperation within learners and to assist learners to learn from their peers (see section 2.2). Although cooperative learning was initially developed to deal with racial integration and increasing achievement of learners in heterogeneous classrooms, it has come to be known for its ability to promote:

- Positive goal interdependence;

- Face-to-face interaction between learners;

- Individual accountability; and
- Social skills like sharing, respect and trust.

Many methods of cooperative learning has been developed and tested thoroughly. Most of these methods have been implemented successfully in science classrooms and have been found to enhance the achievement of learners. Some of the most known methods include the Jigsaw method, Learning together, Group investigation, Student teams achievement divisions and Teams games tournaments.

The literature provides evidence that cooperative learning methods provide a good learning atmosphere in which learners are actively involved, share and participate in the construction of knowledge, work collaboratively and remain on task for prolonged periods. Cooperative learning has also been shown to improve both cognitive and social skills among learners. Some of the skills learnt during cooperative learning refer to what is known as science process skills.

5.2.2 Findings regarding science process skills

Science process skills are regarded as essential in many curricula around the world. In South Africa, science process skills are specified as one of the outcomes that must be acquired by learners when studying science. As such process skills play an important role in the South African curriculum.

Teacher development programmes, however, do not seem to pay attention to the teaching of process skills. Personal communication with other teachers during workshops indicated that this aspect needs closer scrutiny. This is particularly important when taking into consideration that previous research asserts that process skills need to be taught explicitly.

Different methods can be used to teach science process skills. Almost all the strategies used in teaching process skills require learners to actively handle and manipulate the objects being studied. In other words, the teaching and learning of process skills require the use of practical

work. Teachers must therefore use learner-centred teaching strategies like cooperative learning in developing process skills among learners.

Teaching process skills also require close attention to assessment practices followed during instruction. Various assessment strategies will enable the proper assessment of various process skills. The literature indicates that other countries have integrated the testing of process skills in national examinations. In South Africa, practical work is also emphasized in the national curriculum statements.

5.3 SUMMARY OF THE EMPIRICAL FINDINGS

Mixed results were found with regard to the influence of the two cooperative methods used in this study on the development of science process skills. For some process skills, there was an improvement in the achievement of learners after exposure to the cooperative learning method. For other skills, there was no improvement and learners performed worse than prior to exposure to the cooperative learning method.

Firstly, differences in the number of learners who were able to achieve a particular science process skill after exposure to one of the cooperative learning methods were investigated, using frequencies. Different methods were used in the two case studies and as such no comparison is made of the results from the two cooperative learning methods. The results are grouped according to the science process skill only for discussion purposes. In this regard, the following science process skills showed improvement after exposure to the cooperative learning methods.

- In both the Jigsaw and the Group Investigation methods of cooperative learning, more learners achieved the skill of graphing in the post-test compared to the pre-test.

- In both the Jigsaw and the Group Investigation methods of cooperative learning, more learners achieved the skill of experimenting in the post-test compared to the pre-test.

The following science process skill showed no improvement after exposure to the two cooperative learning methods.

- More students achieved the skill of observation in the pre-test as compared to the post-test after exposure to the Jigsaw method of cooperative learning. The subjects exposed to the Group Investigation method achieved the same before and after exposure to the cooperative learning method.

Mixed results were found in the science process skill of controlling variables after learners were exposed to the Group Investigation and Jigsaw methods of cooperative learning.

- More learners achieved the skill of controlling variables in the post-test as compared to the pre-test after exposure to the Group Investigation method of cooperative learning.

- Learners' achievement in controlling variables was lower after exposure to the Jigsaw method than prior to this method of cooperative learning.

To test whether the differences in achievement reported above were statistically significant or not, Wilcoxon Signed Ranked tests were performed for the following two null hypotheses.

Hypothesis one.

The Group Investigation method of cooperative learning has no effect on the development of learners' science process skills of observation, controlling variables, graphing and experimenting.

Hypothesis two.

The Jigsaw method of cooperative learning has no effect on the development of learner's science process skills of observation, controlling variables, graphing and experimenting.

At school A, the null hypothesis was accepted for the skills of observation and controlling variables. The null hypothesis was rejected for the skill of graphing and experimenting. This means that the Group Investigation method did not have any effect on the development of the

skills of observation and controlling variables at school A. On the other hand, the Group Investigation method did have a positive effect on the skills of graphing and experimentation at school A.

At school B, the null hypothesis was rejected for the skills of observation and graphing. This means that the Jigsaw method of cooperative learning influenced, positively, the development of the skill of graphing and influenced, negatively, the development of the skill of observation. On the other hand, the Jigsaw method of cooperative learning did not have any significant effect on the development of the skills of controlling variables and experimentation at school B.

5.4 LIMITATIONS OF THE RESEARCH

The research reported in this dissertation was based on the requirements for a dissertation of limited scope. This and other considerations below resulted in a number of limitations that impacted on the research and thus affect the kind of conclusions that may be made from the data. The recommendations that follow this section should therefore be viewed in light of these limitations.

- The research was based on a case-study format. The subjects of the study were therefore selected based on convenience. As such, no generalisation can be made outside the parameters of the sample used. The results and conclusions made above therefore refer only to the subjects used in the research.
- The attempt to determine the effect of cooperative learning on the development of science process skills required the control of many variables that were not incorporated in this research. As such the conclusions are affected by uncertainty with regard to these uncontrolled variables. For example, the research did not incorporate a control group and the same teacher was not used in the two schools. The latter, for example, introduced uncertainties regarding the effect of teacher characteristics, even though there was no intention to compare the results of the two schools.
- The two case studies in this project used a pre- and post-test research design. However, in the first case study the same instrument (CAT) was used for both the pre-test and the post-test. This could introduce an error in measurement as learners might

have learned the answers to the instrument and hence perform better in the post-test compared to the pre-test. This so-called learning effect therefore might have influenced the results of this study and therefore impacted on the conclusions reached.

- Similarly, different instruments (CAT and NST) were used in the second case study. Although the post-test (NST) was designed to measure the same science process skills measured by the pre-test (CAT), the effect of different instruments might be reflected in the results and thus introduce errors in the measurement.
- Finally, the first case study made use of subjects in a pilot school. Pilot schools were supposed to use learner centred instructional methods like cooperative learning. As such these learners' experience of cooperative learning may not necessarily be due to the intervention.

5.5 RECOMMENDATIONS

The following recommendations are made.

- This study focused only on four science process skills and how they were influenced by two methods of cooperative learning. Further research should investigate other strategies that could enhance the development of process skills among learners in disadvantaged communities. This is particularly important because other strategies might require resources not necessarily available in lower socio-economic communities. In other words, further research is needed on mechanisms to enhance the learning of the different science process skills.

- This study found that the Group Investigation method tended to enhance the development of the process skills of graphing and experimenting. It is recommended therefore that the Group Investigation method of cooperative learning be used when learning concepts that require the skills of graphing and experimenting and that the effect of this method on other process skills not included in this study be investigated.

- Similarly, the Jigsaw method of cooperative learning enhanced performance in the skills of graphing but literally hindered performance in the skill of observation. What was not obvious from the findings was how the Jigsaw method could interfere with

the skill of observation. There is therefore a need to further investigate whether the Jigsaw method does indeed decrease performance in the skill of observation.

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