

## CHAPTER 3 RESEARCH DESIGN AND METHODS

The purpose of this chapter is to explain the research design this study has followed and to justify the methods that were used to gather the data used to answer the research questions the study is based on. For the sake of showing the link between the methods and the research questions I have listed the research questions again in this chapter.

**Main research question:** What was the nature and extent of the pedagogical content knowledge of *Life Sciences* teachers teaching evolution for the first time in South African high schools?

**Sub-questions:**

- What was the extent of the teachers' subject matter knowledge for teaching evolution?
- What common misconceptions associated with evolution did the teachers know about?
- What did the teachers know about likely learning and teaching difficulties they could anticipate when teaching evolution?
- What teaching strategies did the teachers know about how to increase learners' understanding of evolution?
- What was the teachers' curricular knowledge for teaching evolution?

### 3.1 RESEARCH DESIGN

I will start by defining the term "research" as, according to Leedy (1989: 3), the term "research" has been used "*in everyday speech to cover a broad spectrum of meaning, which makes it a decidedly confusing term*" because it has been "*used loosely and given multiple, misleading meanings*". According to Leedy (1989: 5), research is not just an act of collecting data, but it is "*a procedure by which we attempt to find systematically and with the support of demonstrable fact, the answer or the resolution to a problem*". Mouly (1978), as cited in Cohen and Manion (1994:43), defines research as a "*process of arriving at dependable solutions to problems through planned and systematic collection, analysis and interpretation of data*", thus adding the component of data interpretation

According to Leedy (1989:6), research "*must be explicitly planned and logically designed*". As described above, research is systematic and therefore requires an action plan which LeCompte and Schensul (1999) call a "research design". Schumacher & McMillan (1993:157) describe the research design as a "*plan for selecting subjects, research sites and data collection procedures to answer questions*". Simply put, research designs serve as a "*blueprint for action*" as they guide the researcher on how to proceed (LeCompte & Schensul, 1999:62). The blueprint action plan for this study is outlined in Figure 4 on the next page and the details of the sampling and instruments are discussed later in the chapter.

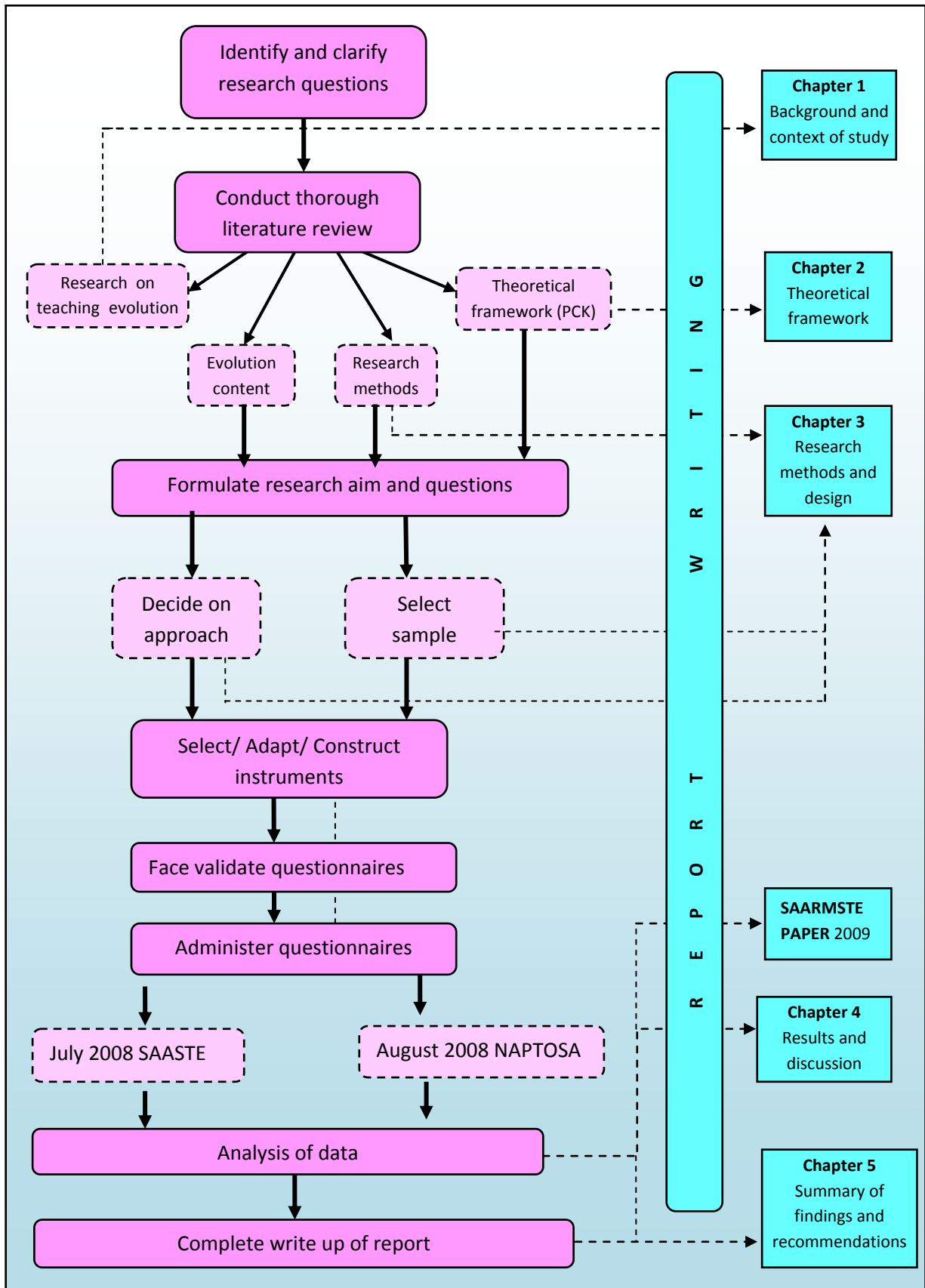


Figure 4: Summary of the research design

The first step in the research was to identify and clarify the problem which the project attempted to investigate. A preliminary literature review was conducted then to allow the researcher to look at what had been written about the question of interest. This was then followed by a thorough literature review about pedagogical content knowledge as a concept and as a framework for the research. Further details of the design are discussed in the rest of this chapter.

### 3.2 RESEARCH PARADIGM

Paradigms are human constructs that deal with principles which define the worldview of the researcher (Denzin & Lincoln, 2000). Johnson and Onwuegbuzie (2004:24) define a research paradigm as “*a set of beliefs, values and assumptions that a community of researchers has in common regarding the nature and conduct of research ... research culture*”. Simply put, a paradigm is a belief system that guides the researcher through a study (Guba & Lincoln, 1994; Smaling, 1994). Guba and Lincoln (1983) list several types of paradigms used in different settings for a variety of reasons. However, there are two distinct and commonly used paradigms which are often associated with theories of knowledge and data-gathering methods in educational research; the positivist and constructivist paradigms.

The positivist paradigm is often associated with the assumptions that there is an objective reality where the researcher is independent of the investigated. This means that in an investigation the researcher is not influenced by what is being investigated and vice versa, what Guba and Lincoln (1994:110) call “*inquiry through a one-way mirror*”. Researchers working within the positivist paradigm often start their investigations by formulating hypotheses, which they seek to verify through experimentation and manipulation of variables so that generalisations, facts and laws can be established. Data collection techniques may include randomized experiments and questionnaires (Sale, Lohfeld & Brazil, 2002). The researchers in this paradigm work within a structured protocol, presenting statistical results represented by numbers (Schumacher & McMillan, 1993). Because of the tendency to use quantitative methods, this paradigm is often misleadingly named “the quantitative paradigm” after the methods used.

The constructivist paradigm is associated with the assumption whose basic tenet is that there are multiple realities which are socially constructed (Mertens, 2005; Sale *et al.*, 2002; Johnson & Onwuegbuzie, 2004). This paradigm acknowledges the subjectivity of the researcher and that the investigator and the investigated are interactively linked so that findings are mutually created (Guba & Lincoln, 1994). Researchers working within this paradigm usually generate hypotheses only after the collection of data and the results are often described, interpreted and presented in words. The techniques used to collect data include interviews and ethnography. Also because of the tendency to use qualitative methods, this paradigm is often misleadingly called “the qualitative paradigm” after the methods used.

However the connection between a paradigm and data collection methods/techniques is not as exclusive as implied in the descriptions above (Bednarz, 1985; Smaling, 1994). Sometimes quantitative researchers use qualitative methods and vice versa (Smaling, 1994). Patton (1980) warns

researchers against positioning themselves in only one paradigm as this is limiting because paradigms have strengths as well as weaknesses for which they are criticized.

The philosophical differences and the underlying assumptions between the two paradigms have been the object of tension and debate for many decades, as researchers from the different camps one claim superiority over the other (Guba & Lincoln, 1994). There has been a strong resistance to mixing methods.

An alternative research paradigm emerged which Patton (1980) called ‘the paradigm of choices’ and which Reeves and Hedberg (2003) referred to as ‘the eclectic - mixed methods - pragmatic paradigm’. This paradigm permits the employment of different kinds of data-collection techniques. I will start by defining each of the words in this paradigm before explaining why it is my paradigm of choice.

**Eclectic** – “*Selecting one’s beliefs etc. from various sources; attached to no particular school of philosophy*” (The Concise Oxford Dictionary, 1990: 371). Reeves and Hedberg (2003) point out that this allows researchers to mix methods from the two paradigms.

**Mixed methods** – Researchers acknowledge that the use of multiple methods is important as it helps to cross check the information collected and the conclusion reached (Reeves & Hedberg, 2003).

**Pragmatic** – This refers to “*dealing with matters with regard to their practical requirements or consequences*” (The Concise Oxford Dictionary, 1990: 935). This means that emphasis is put on practical results rather than predetermined theories and ideas. According to Greene & Caracelli (1997), what should drive the choice of data-collection methods are the practical demands that come with the research questions.

Researchers working within the eclectic - mixed-method - pragmatic paradigm are not restricted by their view of the nature of reality, but deal with the practical reality that researchers are faced with (Reeves & Hedberg, 2003). Researchers working within this paradigm understand that while there are philosophical differences between the quantitative and the qualitative paradigms, their methods can be combined to best address the research questions (Greene & Caracelli, 1997). Researchers within the pragmatic paradigm therefore use suitable research approaches, “*mixed in ways that offer best opportunities for answering important research questions*”, as do pragmatists, according to Johnson and Onwuegbuzie (2004:16). The other advantage of working within this paradigm is that it enables researchers to acknowledge the weaknesses of the research tools used (Reeves & Hedberg, 2003:35).

My paradigm of choice for this study is the eclectic – mixed methods paradigm also known as the pragmatic paradigm. This paradigm allowed me to be flexible, because relying only on a single method can be restricting (Patton, 2002).

### 3.3 RESEARCH APPROACH

The research questions on which this study is based aim at looking at the nature and the extent of the pedagogical content knowledge of a group of South African *Life Sciences* teachers who had to teach evolution for the first time when the topic was introduced into the new curriculum. The purpose of the

research was to identify possible gaps in teachers' pedagogical content knowledge - information that could be used by teacher trainers and curriculum designers to develop appropriate support materials that will help these teachers in gaining access to an understanding about the knowledge needed to teach evolution effectively. A survey approach has been adopted for this study in order to realise these objectives.

Leedy (1989: 141) says the word 'survey' means "*to look or see over or beyond the casual glance*". According to Fraenkel and Wallen (1990:332), researchers use a survey when they want to establish "*how members of a population distribute themselves on one or more variables*". Macmillan & Schumacher (1993:279) say that surveys can be used to "*learn about people's attitudes, beliefs, values, demographics, behaviour, opinions, habits, desires, ideas and other types of information*". Cohen and Manion (1994: 94) indicate that surveys are used "*to gather data at a particular point in time with the intention of describing the nature of existing conditions*". Fraenkel and Wallen (1990:331) outline the structure or characteristics of the survey method for collecting research data as:

- The information is collected from a group of people in order to describe some aspects or characteristics (such as abilities, opinions, attitudes, beliefs and/or knowledge) of the population of which that group is part.
- The main way of which the information is collected is through asking questions; the answers to these questions by the members of the group constitute the data of the study.
- Information is collected from a sample rather than from every member of the population.

According to Keeves (1988), the purpose of using a survey in educational research is twofold: 1. to obtain descriptive information about a target population; 2. to examine relationships between various aspects in order to explain differences between the members of a population.

### 3.4 SAMPLE

Data collection in a survey requires identifying survey respondents from a population who will supply the information required by the researcher for analysis in order to realise the objectives of the study. By definition a sample is a "*set of individuals selected from a population and usually intended to represent the population in a research study*" (Gravetter & Forzano, 2009: 128). Johnson (1977) states that when conducting a survey it is better to collect data from a sample as it costs less and can be done in a short space of time. Sampling allows the researcher to collect data from a small group of a population rather than the entire population and the results obtained can be generalised to the entire population if the sample was carefully selected so that it is a representation of the larger population.

Random sampling would be an ideal sampling technique, as all the members of a population have an equal and independent chance of being selected and bias is reduced (Leedy, 1989). However, this is not always feasible in an educational setting. One of the more commonly used sampling techniques is therefore convenience sampling, which involves collection of data from individual participants who are available and willing to respond (Gravetter & Forzano, 2009). Leedy (1989) asserts that

convenience sampling does not claim to be representative of a population, thus limiting generalisation of results to the larger population.

In this study convenience sampling was used to gather data about *Life Sciences*, where teachers who were to teach evolution for the first time, were the target group. Data was collected in two separate workshops:

**SAASTE:** The first set of data was gathered at a workshop which was part of a conference programme for the South African Association of Science and Technology Educators. The workshop was part of the conference programme, and an explanatory notice and booking schedule were posted on the notice board for all interested *Life Sciences* educators who were attending the conference. This sample comprised 38 teachers of different racial groups from different provinces of South Africa.

**NAPTOSA:** The second workshop was organised for the National Professional Teachers' Organisation of South Africa (NAPTOSA) through Abbott College after their members (many of whom are *Life Sciences* teachers) raised concerns regarding lack of adequate training for the teaching of evolution. Invitations were sent by NAPTOSA to its members in the Gauteng Department of Education. The first sample (NAPTOSA) comprised 40 teachers of different racial groups from Gauteng public high schools, both former Model-C and previously disadvantaged schools. Former Model-C schools are schools which are situated in better-developed areas and are adequately resourced (with laboratories and equipment) and only slightly dependent on the government, while previously disadvantaged schools are situated in less well developed areas, and are often not as well-equipped, and totally dependent on the government for funding.

In both the cases the participants comprised a sample of convenience as they were available and willing to participate. The aim of the workshops were twofold:

(i) to introduce teachers to the concept of pedagogical content knowledge for teaching evolution by allowing them to explore and improve their knowledge of:

- the content knowledge required for the teaching of evolution,
- the available curricular resources,
- the likely difficulties in evolution teaching (theirs and the learners),
- the common misconceptions associated with evolution, and their importance,
- the best ways to teach evolution to avoid potential conflict, and to promote understanding.

(ii) to collect data for the study.

### 3.5 DATA-COLLECTION INSTRUMENTS: QUESTIONNAIRES

According to Fraenkel and Wallen (1990) data is information that researchers gather on the subject of their research. LeCompte and Preissle (1993) say that the information that researchers gather can be

used to answer the research questions. Surveys can use different data collection techniques such as questionnaires, tests, attitude/rating scales, checklists and interviews. I choose the technique that will ensure that the data collected provides appropriate answers to the research questions.

In this study questionnaires were chosen as data-gathering instruments due to time constraints and the geographical proximity of the respondents (especially those in the second sample). Wolf (as cited in Keeves, 1988) explains questionnaires as self-report instruments for collecting data about variables that are of interest to the researcher, a “*self-administered interview*” (Smith, cited by Henderson, 1978). Galfo (1995: 27) says that the purpose of using questionnaires is to “*obtain factual data, opinions and attitudes in a structural framework from respondents not contacted on a face-to-face basis*”. Wolf (cited by Keeves, 1988: 479) outlines three assumptions on which a questionnaire is based and explains that these assumptions should be tested through piloting if the questionnaire is to be used with confidence. The assumptions are:

- The respondent can read and understand the questions or items.
- The respondent possesses the information to answer the questions or items.
- The respondent is willing to answer the questions or items honestly.

A review of literature shows that a good questionnaire must have the following characteristics:

- It must be attractive in appearance, to elicit interest of the respondents to complete the questionnaire (Oppenheim, 1966; Berdie & Anderson, 1974; Fraenkel & Wallen 1990).
- The questions should be short, only long enough to get the necessary information, so that respondents do not get discouraged or bored (Cohen & Manion, 1994; McMillan & Schumacher, 2001).
- The questions must be relevant and objective, so that the respondent not confused about the purpose of the questionnaire (Cohen & Manion, 1994).
- Question must be presented in a logical order, like from general to specific, so as to help the readers to organise their thoughts (Oppenheim, 1966).

Using questionnaires to collect data has several advantages. The first advantage is that it is less costly (economically) as compared to using interviews, as questionnaires can be mailed to many participants who may be widely scattered (Oppenheim, 1966; van Dalen, 1973; McMillan & Schumacher, 2001). The second advantage is that it can be administered to a large number of people at the same time (Fraenkel & Wallen, 1993), unlike the case of interviews. The third advantage is that the researcher does not necessarily have to be there, thus reducing bias (Galfo, 1975; McMillan & Schumacher, 2001). The fourth advantage is that the researcher can ensure anonymity and confidentiality to the participants, which may also serve as a means of obtaining cooperation from the respondents (Oppenheim, 1966; McMillan & Schumacher, 2001). The fifth advantage is that the respondents have ample time to think about their responses (McMillan & Schumacher, 2001). The sixth advantage is that if the questions in the questionnaire are highly structured and the conditions under which it is administered are controlled, then the questionnaire could become standardised.

However, like any other data-gathering technique, questionnaires are not without limitations. The following are the identified limitations:

- **Effort needed to construct the questionnaire** – designing questions that directly relate to the aim of the study requires extensive planning, reading, designing and piloting, as rightly pointed out by Keeves (1988:479) when he says that it requires a “*great deal of painstaking developmental work*”.
- **The poor response rate** – this applies especially to mailed questionnaires, as not all the recipients respond, resulting in poor return rates (Oppenheim, 1966; McMillan & Schumacher, 2001). The poor return rate introduces bias and may render the data obtained useless (van Dalen, 1973).
- **Absence of the researcher** – should the respondents need clarity on the some questions, the researcher is usually not present to offer such clarity. This may introduce the question of validity of the responses given. Also, there may be more than one respondent in an institution so it is possible that they may discuss their responses and influence each other’s views and the researcher is not present to control that.
- **Low respondent motivation** – it is difficult to assess the motivation of the respondents’ responses as they may hide their real attitudes and give what they perceive to be acceptable opinions/attitude especially where being assured of anonymity, thereby affecting the validity of their responses (Oppenheim, 1966).

In this study activity-based questionnaires were used to gather data from the teachers at workshops. The term “activity-based questionnaires” was taken from the concept of activity-based learning which involves learning by doing and reflecting on what one is doing (Mashalaba, 2005). This involves mind-on and hands-on activities. The activities in the workshops were designed to facilitate communication between the respondents, their peers and the facilitator. Ngxola and Sanders (2008) describe activity-based questionnaires as serving two purposes (i) to engage teachers in workshop activities to get them thinking about a particular aspect of their teaching and (ii) to collect research data.

Keeves (1998) asserts that researchers are at liberty to use already developed questionnaires to collect data for answering the research questions. According to Hyman, Lamb and Bulmer (2006) the advantage of using pre-existing questionnaires is that they have been tested at the time of first use. But this has some limitation that the questions may not provide researchers with the relevant information. However, Hyman *et al.* (2006) suggest that researchers may adapt the questions according to need in order to address this limitation.

Three questionnaires designed by Ngxola (2012), and addressing the topic of evolution were used for this study (questionnaire 2, 3 & 4). Those items which best addressed the research questions for my study were selected and used. Some of the items in the questionnaires were adapted to the research questions for this study. The questionnaires contained closed-ended and open-ended questions which allowed the respondents to explain their opinions and feelings and in some instances to elaborate on their choice of answers. The remaining four questionnaires were developed from scratch for my study



(questionnaire 1, 5, 6, & 7). Questionnaires 5, 6 & 7 we designed based on the four categories of PCK model used in this study. Questionnaire 5 was based on teachers' curricular knowledge, questionnaire 6 was based on teachers' knowledge of learners' learning difficulties and the teachers' difficulties that they anticipate when teaching evolution, and the last questionnaire was based on the teachers' knowledge of prior ideas including misconceptions about evolution that learners may bring to class. All the questionnaires 2-7 are based on the five categories of PCK.

The workshop activities were linked to the activity-based questionnaires. Seven activity-based questionnaires were used to collect data.

- **Questionnaire 1 - General information:** this questionnaire required the respondents to supply information about their background regarding teaching evolution. This included information about their teaching experience as *Biology* teachers, their tertiary qualifications, if they had learnt about evolution during their tertiary education, whether they have received training on evolution content, and their lesson preparation activities (see Appendix C1).
- **Questionnaire 2 - Explain what you think is meant by “evolution” in biology:** the activity involved an open-ended question aimed at finding out if teachers could correctly explain what evolution is as this could give an indication of their subject matter knowledge with regards to evolution. An explanation would require the teachers to what biological evolution is and how it occurs (see Appendix C2).
- **Questionnaire 3 – Evolution quiz:** the activity entailed a true-or-false quiz, and was aimed at identifying the teachers' misconceptions as well as establishing their subject matter knowledge regarding evolution (see Appendix C3).
- **Questionnaire 4 – Do you think you know enough about teaching evolution to teach it?** The activity contained concepts which teachers were required to teach according to the 2008 Grade 12 examination guidelines. It was aimed at finding out the teachers' perceptions of how well they knew these fundamental concepts, i.e. to elicit their confidence in their own subject matter knowledge (see Appendix C4).
- **Questionnaire 5 – Knowing what is taught about evolution, and when:** the activity was aimed at finding out teachers' knowledge about aspects of evolution taught in other subjects and grades and what those aspects are. They were asked to indicate their levels of confidence (if they are very sure, fairly sure or not sure) about the amount of detail they should include when teaching about evolution. They were also required to indicate their knowledge level regarding the available resources for teaching evolution. The activity was aimed at evaluating their curricular knowledge with regard to the teaching of evolution (see Appendix C5).
- **Questionnaire 6 – Having to teach evolution as a school subject in 2008:** the activity required the teachers to think about the likely difficulties they personally and the learners might experience during the teaching and learning of evolution. The aim was to find out if they were aware of the difficulties associated with teaching evolution. (See Appendix C6).
- **Questionnaire 7 – Prior ideas learners bring to class:** the activity required the teachers to list the known misconception/ prior ideas regarding evolution that learners might bring to class and to also indicate how they found out about these misconceptions. The aim was to find out if they

know the importance of misconceptions and how these can be used to facilitate learning (see Appendix C7).

### 3.6 ENSURING RIGOUR IN THE STUDY

In order for educational research to be of practical use it is very important that the researcher ensures that the results are as valid and reliable as possible. Many researchers agree on the same definition for validity, which is a degree to which the item or instrument accurately measures what it was intended to measure (Bell, 1987; Keeves, 1988; Fraenkel & Wallen, 1990; Gravetter & Forzano, 2009). But Fraenkel and Wallen (1990:90) point out that validity also includes “*the defensibility of the inferences researchers make from the data collected through the use of an instrument*”. Simply put, validity measures the quality of the research process and the accuracy of the results (Gravetter & Forzano, 2009). Sanders and Mokuku (1994) warn that if the researcher cannot give an assurance of the authenticity of the results, then the study becomes meaningless.

It is important for researchers to take into cognisance threats to the validity of the study. A threat is any factor of the study that may raise doubts about the quality of the study (Gravetter & Forzano, 2009). In this study the following threats were considered:

- The questionnaires were not piloted for two reasons. Two of the questionnaires were existing instruments, which had already been used and face-validated for other studies. However, Schumacher and McMillan (1993) warn that an instrument can be valid for one study but lack validity for another study. The second reason was the lack of time before the workshops was insufficient for the instruments to be piloted.
- The short duration of the workshops used to collect data. The participants had limited time to respond to the questionnaires, thus important information might have been missed.

Reliability is the consistency of the measurement procedure in producing the same or nearly the same results if the procedure is used on similar people under similar conditions (Fraenkel & Wallen, 1990; Schumacher & McMillan, 1993). The assumption in reliability is that the variable being measured is constant (Gravetter & Forzano, 2009). Reliability is a function of validity and if data is not reliable then automatically validity of the study becomes questionable (Gravetter & Forzano, 2009).

Increasing the levels of reliability and validity depends on well-designed research instruments and the proper execution of the data-gathering procedures. In this study several strategies were used to improve reliability and validity of the study in order to improve the rigour in the research.

- **Face-validation** - Face-validity involves asking an expert to check for “content or for construct validity” (Sanders & Mokuku, 1994). Those items in the questionnaires that were altered were face-validated by my supervisor, a first-language English speaker who teaches evolution and is also an experienced researcher in science education. She checked if the language used in the questionnaires was appropriate and understandable, that the questions were properly sequenced and if the questions were relevant to the study.

- **Triangulation using different questions to evaluate subject matter knowledge** – The questionnaire on evolution quiz and prior ideas learners bring to class were both aimed at identifying teachers' knowledge of the misconceptions about evolution. Also, Questionnaire 2 and 3 were both aimed at identifying the extent of teachers' subject matter knowledge about evolution.
- **Checking frequency counts** – a colleague and I did the frequency counts on those responses that required tallying and the frequency count was validated by the science education expert mentioned above.
- **Inter-coder reliability** – coding of the open-ended questions was checked by an experienced researcher and a science education specialist.

### 3.7 ADMINISTERING THE QUESTIONNAIRES

The questionnaires were administered in a workshop setting on two separate dates. The first workshop was run as one of the sessions in the SAASTE conference held in July 2008. The second workshop (NAPTOSA) was run in August 2008. Both workshops were run just a few weeks before the actual teaching of evolution.

At the beginning of each workshop, the facilitator outlined the purpose of the workshop. She also introduced the research team (several researchers involved in researching the teaching of evolution, including myself) to the participants. It was indicated to the participants that taking part in the study was voluntary. Those who agreed to participate by submitting their responses for copying for research data were asked to complete a consent form (Appendix D). Before the administration of each questionnaire the workshop facilitator explained the instructions to the participants even though the instructions were written on the questionnaires. The participants were seated in groups of four even though the activities were completed individually. After the completion of each activity, two of my colleagues and I collected the questionnaires, which were then photocopied and then later returned to the correct participants to keep. Each of the activities was discussed after the participants had been given their questionnaires back. Each table where the teachers were seated was numbered, and each activity sheet had a space for the table number and the teachers' initials, for easy identification of the teachers so the questionnaires could be returned to them.

### 3.8 ANALYSIS OF DATA FROM THE QUESTIONNAIRE

The construction of data-gathering instruments and the modes of responses determine how the data will be analysed. Data can be analysed in two ways, through numbers (quantitatively) or through words (qualitatively). The questionnaires in this study were made up of restricted (close-ended) items and unrestricted (open-ended) items (Cohen & Manion, 1986).

Close-ended questions consist of items with a fixed number of responses, and are usually analysed by frequency counts and expressed in percentages. Open-ended questions consist of items that allow

participants to express their ideas and opinions. They are usually analysed by using open-coding. This involves analysing trends and patterns within the responses and generating categories (Cohen & Manion, 1986).

In this study frequency counts were used to analyse the close-ended questions and open-coding was used to analyse open-ended questions. The frequency counts were verified by the science education expert together with the researcher. As data for the questionnaires were captured, I studied it several times in order to familiarise myself with it. I noted patterns and trends that emerged from the data, and these were used to develop categories which were used to analyse the results. The categories were verified by the science education expert for their appropriateness, before being used to analyse the data. Inter-coder reliability was performed, with both my supervisor and myself independently coding the answers, comparing results, and coming to agreement after discussing the few minor differences.

### **3.9 ETHICAL ISSUES**

Simply put ethics involve certain standards agreed upon by members of a group to regulate their behaviour (a code of conduct). In research, ethics involves a set of guidelines to assist the researchers to make proper decisions and choose proper action (Gravetter & Forzano, 2009). It is the responsibility of the researchers to treat their participants in their study with dignity and respect, and to make sure that the results of the study are reported with honesty. The proposal of this study was sent to the Human Research Ethics Committee (Non-Medical) at the University of the Witwatersrand for approval (see Appendix E). The following are the ethical responsibilities which were considered in the study:

- Teachers were informed about the study and its purpose.
- Anonymity and confidentiality were promised, and ensured by the use of teachers' initials and table numbers for identification.
- Consent was obtained from the participants to use their responses for the research study.
- The participants were given contact details of the researchers and the facilitator should they have questions regarding the study at a later stage.

### **3.10 CONCLUDING REMARKS**

This chapter was a detailed attempt to explain and justify the processes that were employed to gather data used to answer the research questions. The data collected and the analysis will be discussed in the next chapter. In the analysis of the results, quotes from the teachers are referenced using codes e.g. #29.N or #3.S. Individual teachers were given numbers for each of the workshops. The teacher codes for the SAASTE workshop are followed by a dot and "S" indicating the SAASTE workshop, and for the NAPTOSA workshop the dot is followed by "N".