

Chapter #14

TEACHING EVOLUTION TO GRADE 12 LEARNERS: TEACHERS' VIEWS AND PEDAGOGICAL PRACTICES

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ABSTRACT

The world over, evolution has proved to be a contentious topic to teach to high school learners despite its value in acting as 'a blending concept' in Biology. In the South African Life Sciences curriculum, evolution accounts for 44% of Grade 12 content in terms of mark allocation in examinations. Hence teachers are obligated to address the topic adequately as there are accountability issues at the end of the year. However, previous research has shown that teachers question the theory of evolution and are conflicted to teach it. In the current study 15 teachers were each interviewed once to explore their individual views about evolution and the pedagogical practices they employ when teaching the topic. Qualitative analysis of data showed teachers' mixed views about the content of the topic of evolution, the value of that content to learners and society in general and the best approaches to teach the topic in science classrooms. The study revealed that at times teachers failed to reconcile their beliefs and those of the learners against their science classroom practices. In conclusion, teachers who lack the understanding of the nature of science have difficulties in teaching the topic evolution for scientific understanding. There is need for teacher professional development programmes in this regard.

Keywords: teachers' views, pedagogical practices, evolution, grade 12 learners.

1. INTRODUCTION

Worldwide, the teaching of evolution in high schools has been a controversial issue. There had been lawsuits in America where creationists feel discontented with the theory of evolution and advocate for the theory of 'intelligent design' (ID) as an alternative in explaining the diversity of life on earth (Getz, 2006). However, ID has been discredited as unscientific and labelled a religious view (Getz, 2006). Though most researchers prefer to use the phrase the 'evolutionary theory' instead of the 'theory of evolution', the current study uses the later. The theory of evolution encompasses all branches of biology which span from molecular genetics to ecology. In a study of 926 American teachers by Berkman and Plutzer (2011) 13% of the teachers advocated for the teaching of creationism or ID against 60% who were not comfortable in choosing the former or evolution. Hence evolution is still a socio-scientific controversy in America (Hermann, 2008), in some countries in Africa and Asia (Clément, 2013). In a study carried out in 30 countries to determine teachers' conceptions related to evolution and to the separation between science and religion, Clément (2015) found diverse teachers' conceptions across countries ranging from extreme evolutionist to extreme creationist. The study also showed that teachers from economically less developed countries tend to believe more in in creation and upheld their religion as compared to those in economically developed countries.

1.1. The need to teach evolution

Sager (2008) noted that many scientific and religious organisations in education have expressed the need for the teaching of evolution due to its controversial nature. However, there is still resistance in different nations for example the United Kingdom and South Africa as well, such that there is a lot of inconsistency in how evolution is addressed in different curricula (Hermann, 2013). In addition, there is limited research that has been done to determine teachers' conceptions of the theory of evolution (Rutledge & Mitchell, 2002). In a study to determine Indiana teachers' conceptions and knowledge structures of evolution Rutledge and Mitchell (2002) found a distinct pattern of increased teacher acceptance of evolution with increased subject matter coverage during teacher preparation programmes. Their study also revealed the trend that teachers with increased acceptance of the theory of evolution devoted more time in teaching and the reverse was found to be true. In another study Coleman, Stears and Dempster (2015) sought to determine the existence of any relationship between South African University pre-service teachers' understanding of evolution and the Nature of Science (NOS). The study also determined the pre-service teachers' level of acceptance of evolution. The research revealed that the participants had a relatively higher level of acceptance of evolution. Notably, it showed the independence of conceptual understanding of evolution and the changes in beliefs about the NOS.

Previous research showed that teachers' attitudes and views about subject matter may influence the decisions they make about the curricular and instruction (Grossman, 1989; Wilson, Shulman, & Richert, 1987). Therefore, if a Life Sciences teacher accepts or rejects the theory of evolution as a scientifically valid explanation, the degree to which the teacher treats evolution concepts is affected. Because learners' knowledge structures resemble those of their teachers (Bartos & Lederman, 2014), teachers' conception and knowledge structure of evolution may impact those of their learners (Rutledge & Mitchell, 2002; Coleman, et al, 2015). Consequently, existence of misconceptions about evolution within teachers result in them transferring the same misconceptions to learners through their instruction (Mpeta, De Villiers, & Fraser, 2015).

1.2. Factors impeding the teaching of evolution in high schools

Evidence from previous studies showed that the instruction of evolution in high schools may be absent or marred with superficial or distorted information (Shankar & Skoog, 1993). Factors that cause instructional inadequacy of evolution include restrictive curriculum policies, opposing religious groups poor content coverage in textbooks (Shankar, 1990; Zimmerman, 1987) and teachers who lack capacity to teach the content (Rutledge & Mitchell, 2002).

Researchers have acknowledged that generally teachers experience problems in teaching evolution. In particular, Mpeta et al (2015) noted that the teachers are constrained by learners' different worldviews, which might be in conflict with the theory of evolution. In South Africa evolution is taught to learners of diverse socio-cultural backgrounds. As such, the controversy in the classroom is intensified as learners bring different views and beliefs that conflict or clash with scientific knowledge. de Beer and Henning (2013) noted that the controversy arises as teachers struggle to assist in resolving religious differences and objections from learners. Amongst the problems are that teachers lack a clear conceptualisation of evolution, which stifles the ability to teach it properly and that due to their religious background, they have problems in accepting evolution as an important and key principle in Biology (Coleman et al., 2015). It is important for teachers to have a deep understanding of the principles underpinning the NOS and the content of evolution (Lederman, 1992) for proper teaching and engagement with the content in the science

classrooms (Coleman et al., 2015). Previous research showed that teachers find it difficult to understand concepts on evolution (Kirsten, 2014) and that there is inconsistency between teachers' and learners' beliefs about the NOS (Abd-El-Khalick & Lederman, 2000), which causes problems in the science classroom.

2. BACKGROUND

In the South African Life Sciences curriculum, evolution accounts for 44% of Grade 12 content in terms of mark allocation in examinations. Hence teachers are obligated to address the topic adequately as there are accountability issues at the end of the year. Unfortunately, previous research showed that South African teachers question the theory of evolution and are conflicted to teach it. Teachers' personal views on a topic or subject matter heavily influence or determine how the topic is treated in the classroom (Coleman et al., 2015). Previous researchers alluded to the existence of a relationship between teachers' acceptance of evolution and the emphasis and level of how they teach it (Deniz, Donnelly, & Yilmaz, 2008). One difficult issue with the teaching of evolution is that it may not be taught with the objective of making learners accept it as Meadows, Doster, and Jackson (2000) argued that it would be unethical. This is related to a study by Mpeti et al (2015) where some learners indicated that they felt their teacher was persuading them to accept evolution and renege their religious beliefs. The onus is on the learners to make a decision on whether to accept or reject evolution (Sinatra, Southerland, McConaughy, & Demastes, 2003). In consideration of scientific views and the NOS one should teach learners for understanding. In a study to explore factors related to acceptance of evolutionary theory among Turkish pre-service biology teachers, Deniz et al. (2008) found out that evolution understanding was related to acceptance of evolutionary theory. In reality many people with strong religious beliefs are bound to reject evolution as they perceive that acceptance of the theory of evolution and belief in creation cannot coexist (Deniz et al., 2008).

The topic evolution was introduced into the South African Life Sciences curriculum in 2008. Understandably therefore the problem of poor instruction of the theory of evolution emanates from the fact that the current teachers were not taught evolution during their high school years or they were taught by teachers who themselves had not been exposed to the content and pedagogical practices suitable for the topic. Therefore, the underlying issue is that these teachers do not accept the theory of evolution fully (Coleman, 2006), and they are scared to teach content for which they feel inadequately prepared (Ngxola & Sanders, 2008).

3. OBJECTIVES AND RESEARCH QUESTION

The study sought to explore Life Sciences teachers' views and pedagogical practices when teaching the topic evolution to Grade 12 high school learners. Accordingly, the study sought to answer two research questions: 1. How do Grade 12 Life Sciences teachers perceive the teaching of the topic evolution to Grade 12 high school learners? 2. What are their pedagogical practices when teaching the topic evolution to Grade 12 Life Sciences learners?

4. RESEARCH METHODOLOGY

In a qualitative case study research design 15 practising novice and experienced Life Sciences teachers, nine females and six males were each interviewed once to determine their views and pedagogical practices when teaching the topic evolution to Grade 12 learners. The design was appropriate for the study as it is a naturalistic approach that sought to understand phenomena in context-specific settings (Grade 12 Life Sciences teachers teaching evolution), where the researcher did not manipulate the phenomenon of interest (Patton, 2002) but probed for deeper understanding rather than examining surface features (Johnson, 1995). Previous research studies in education have used case-study research design mostly to explore the processes and dynamics of practice (Merriam, 1998) in order to shed light on a phenomenon, the process, events, persons or things of interest to the researcher (Gall, Gall, & Borg, 2003).

The researcher provided the teachers with three hypothetical scenarios of teachers teaching the topic evolution to high school learners (see appendix), which provoked or stimulated teachers to revisit their thought processes on how they have taught the topic that year and during the previous years. A semi-structured interview schedule (see appendix) was used for the interviews. The researcher's probing questions evoked responses from the teachers which provided an insight into the: teachers' views about the content of the topic evolution; need for continued inclusion of the topic in the curriculum; value of the content and skills to learners and society in general; the approaches teachers used to teach the topic in terms of the manner in which they introduced it to the learners and the teaching strategies and activities employed. Each interview lasted 45 to 60 minutes, was captured using an audio-recorder and then transcribed verbatim immediately after each interview. Data analysis involved identifying codes then analysing data using Atlas ti version 8 to determine recurring themes from the data (see table 1).

Semi-structured interviews were suitable for this study because they are neither as restrictive as fully-structured interviews nor as flexible as unstructured interviews (Karasar, 1995). At the same time, semi-structured interviews allowed the teachers to tell 'their own stories' in their own words, so that the issues the researcher had not thought of arose (Hatton & Smith, 1995).

Table 1.
A coding and analysis sample of data from interviews.

Codes	Categories	Emerging themes
i. Topic is difficult. ii. Topic is too broad. iii. Has a lot of content. iv. Still struggling with ways to deal with the topic.	Lack of content knowledge. Lack of conceptual understanding.	Teachers have poor content knowledge and hence pedagogical content knowledge.
i. A sensitive topic. ii. Heated debates as learners get an opportunity to raise their opinions. iii. Make it clear the distinctive roles of science and religion, the two need not be in conflict.	Controversial issues arising. Failure to manage proper teaching and learning.	Teachers conflicted to teach concepts due to own beliefs and those of the learners.
i. Still struggling with ways to deal with the topic. ii. No one to ask or share any ideas. iii. No one shows me how to teach the topic. iv. Lack of support for novice teacher. v. Struggling to find suitable strategies to teach the topic. vi. Failure to come up with suitable activities, only utilise those in the textbooks.	Poor support system. Lack of pedagogical skills. Failure to formulate authentic activities for the learners.	Novice teachers lack appropriate pedagogical knowledge and skills to teach concepts meaningfully.

<ul style="list-style-type: none"> i. Use teaching strategies that do not challenge learners' beliefs. ii. Focus on content coverage. iii. Avoid debates and discussions as they raise emotions. iv. Asking learners' views may create challenges and problems with parents. v. Respect learners' decisions if they choose to keep quiet. 	<p>Focused on content coverage. Not worried about learner understanding of concepts. Very conservative.</p>	<p>Teachers are conservative and do not explore inquiry-based approaches to teaching and learning.</p>
<ul style="list-style-type: none"> i. Consulting and using different sources. ii. Provide questions which learners should explore. iii. Involve learners in providing explanations for some of the theories. iv. Allow learners to engage and ask questions. v. Building a bridge from learners' existing worldviews to new perceptions. vi. Address learner misconceptions. vii. Debates and group discussions are important. 	<p>Teacher use of learner-centred approaches. Interested in facilitating learner understanding of concepts and not teach for examinations. Scaffolding emphasised</p>	<p>Teachers are progressive and explore various ways to ensure learner understanding of concepts.</p>

5. RESEARCH FINDINGS AND DISCUSSION

Analysis of the teachers' responses showed teachers' mixed views about the content of the topic of evolution, the value of that knowledge to learners and society in general and approaches suitable to teach the topic in the science classrooms. Teachers attested to the use of higher order questions, debate, argumentation and group discussion as strategies that allow learners to share their opinions based on their diverse cultural and religious background. The study also showed that sometimes teachers failed to reconcile their beliefs and those of the learners and their science classroom practices. The findings are presented under four subheadings that follow.

5.1. Teachers' views on the content of the topic of evolution

The majority of the participants (9 out of 15 teachers) had the view that evolution was the most complex and controversial topic compared to any other Life Sciences topics in the curriculum. They raised issues that the topic contradicts some of the people's socio-cultural beliefs, challenges different religious beliefs and raised concerns on the truth of the content and reliability of its evidence. As such, teachers pointed out that the concepts are controversial, particularly in a science classroom of learners from diverse cultures, which results in a clash between science and learners' belief systems.

The teachers complained that the topic is difficult, which shows that they have inadequate content knowledge of the topic. The findings show that teachers' academic background and personal religious beliefs impact on their acceptance of evolution and consequently on the teaching process. The teachers also indicated that evolution is too broad and has a lot of content that needs to be covered within a short period of time before the learners write final Grade 12 examinations. As such, learners do not have enough time to engage with the topic. They wished the content was distributed evenly from Grade 10-12. The novice teachers (3 out of 15) indicated that they lacked support as there were no readily available mentors who would coach them on how to teach the topic better. As such, the novice teachers struggled to identify suitable ways of dealing with the topic particularly in formulating suitable activities. Hence they relied heavily on available textbooks.

5.2. Teachers' views on the need for continued inclusion of the topic evolution in the curriculum

Almost three quarters of the teachers (11 out of 15) acknowledged the importance of inclusion of the topic evolution in the curriculum for a number of reasons. Firstly, they argued that evolution covers important content that spans beyond the educational boundaries and taps into learners' experiences. Secondly, they indicated that evolution exposes learners to different fields of study. The other reason is that evolution provides a background for Life Sciences subject as a whole. One of the teachers said, "In any case it is important for human beings to know their origins". This showed how much they valued the content of evolution.

Teachers also argued for the inclusion of evolution in the curriculum as they feel that the topic develops a repertoire of skills in the learners. Evolution promotes learners to think deeper and be able to critique their belief systems against the scientific knowledge or vice versa. The majority of the teachers (13 out of 15) pointed out that by learning the theory of evolution, learners develop the desire to study more, solve problems and make intelligent choices in life. Teachers viewed evolution as a topic that promotes learners' understanding and application of science as it provides practical scientific examples in their lives. They also pointed out that in examining the different views and theories that support or oppose evolution, learners develop skills in assessing different sources of evidence and realise that reasonable compromise is often an important part of democratic decision-making process. In this case teachers were referring to experiences learners go through when considering various viewpoints such as creationism, big bang theory, and Lamarckian theory vis a vis natural selection. Notably, three of the teachers pointed out that learners develop understanding of the strengths and weaknesses of data in any scientific investigation.

In interpreting teachers' views, it shows that learners are exposed to the tenets of the NOS, which may not be so apparent when teaching other topics in Life Sciences. Two of the teachers (those with post graduate qualifications) attested to the fact that learners acquire knowledge of how science can resolve issues and thereby develop critical thinking skills, skills to use rational methods when planning some investigations and also in considering significant issues in any scientific practice. Most importantly several teachers (5 out of 15) pointed out that when learners are taught evolution properly, they develop positive attitudes and willingness to recognise and accept differing viewpoints, which is a valuable skill in science and is a normal process in real life situations.

Contrary to the majority of the teachers' views, there were two teachers who strongly felt that the content of evolution was not important to all learners considering some of the job opportunities some learners would pursue. When probed further, these teachers would not elaborate on their views. One could infer that the two teachers had strong religious beliefs, which were conflicted by the theory of evolution.

5.3. Teachers' views on how the topic evolution can be introduced to learners

When asked about how they normally introduced the concepts on evolution, 60% of the teachers (9 out of 15) were quite clear that in as much as they are conflicted by their own belief systems and those of the society in general, evolution should be introduced to learners in an enthusiastic manner. They indicated that such introductions dissolve the boundaries of socio-cultural prejudices and facilitate learners to express their opinions without the teacher constraining them. Teachers alluded to the fact that when introducing the topic, one should not shy away from addressing important issues due to religious affiliations and resistance from learners. A third of the teachers, however indicated that such introductions retard the progression of the lesson as more time is spent on the

introduction at the expense of content coverage. Teachers (8 out of 15) provided a range of ways that evolution can be introduced to learners. These include introducing the topic as an integral part of NOS, that means teaching using inquiry approaches, use of role play with learners taking different roles ranging from being plant species, microorganisms to primates living in one community, use of question and answer technique to elicit learners' prior knowledge or misconceptions and use of videos to capture learner attention.

5.4. Teaching strategies and activities teachers employed

Teachers were forthcoming in suggesting teaching strategies and activities that can be employed in teaching evolution to Grade 12 learners. There were two groups of teachers, i.e. those who were 'conservative' (7 out of 15) and the 'progressive' ones (8 out of 15). 'Conservative' teachers indicated that they were conflicted in teaching evolution due to their religious beliefs. As such, they had reservations in exploring the concepts deeper to enhance learner understanding. Such traditional teaching practices (lecture methods) where learners' opinions are not recognised can result in learners developing a distorted view of evolution leading to its rejection (Mpeta et al., 2015).

The 'progressive' teachers were those who despite their religious beliefs, portrayed that they confidently and competently engaged learners fully in the teaching and learning of concepts in evolution. Such teachers understood the principles underlying the NOS. The 'progressive' group mentioned teaching strategies and activities such as engaging learners in controversial debates and then guide learners in building consensus, use of scenarios or case studies familiar to learners, using higher order questions, which stimulate small and large group discussions and argumentation. They emphasised that the suggested strategies and activities create a classroom atmosphere that is positive, and openness encourages learners to 'take a position' and make meaningful decisions. The use of open ended questions is critical as learners explore and build bridges between their existing worldviews and new scientific knowledge and divergent thinking is encouraged. Learners would share their opinions and ideas in group discussions, learn from each other and get an opportunity to justify or refute their previous view points (in an argumentation process) after consulting different sources of information. Cavagnetto (2010) insists that if learners participate in an argument, they develop communication skills, metacognition, critical thinking and understand the culture and practice of science and scientific literature. As such, learners are challenged to develop a position based upon what they will have discovered in their search for evidence and in that way, they learn scientific content (Klosterman & Sadler, 2011).

The 'conservative' group of teachers indicated that direct instruction (use of transmission method of teaching such as lecture methods) is sometimes suitable because such a teaching strategy does not challenge learners' beliefs and allows teachers to provide explanation of the content easily. The teachers also felt that such teacher explanations address learner misconceptions and not much time is wasted to allow completion of syllabus before examinations and learners only ask relevant questions without straying from the curriculum requirements. To show how teacher-centred the instruction they advocated for were, one of the teachers in the 'conservative' group said, "When you stick to the textbook content after consulting different sources, you are safeguarding yourself from any criticism from the parents". These teacher practices show lack of understanding of the theory of evolution and the NOS, which cause them to teach the topic to learners in an isolated manner, leaving room for misinterpretations and misconceptions by the learners (Coleman et al., 2015). Rutledge and Mitchell (2002) noted that due to lack of an understanding of evolution and NOS, teachers may be incapable of making informed decisions regarding acceptance or rejection of the theory of evolution. Such teachers fail to make appropriate instructional decisions regarding their teaching.

Important teaching strategies raised by the eight teachers in the 'progressive' group include taking learners for excursions so that learners can study the organisms in their natural environment for example in forests or botanical gardens and in museums. Through the excursions, learners make their own decisions based on their observations and discussions and not solely rely on the textbook information. These teachers mentioned the importance of addressing learner misconceptions when teaching the topic evolution as most learners remain with their ingrained wrong or alternative conceptions. The teachers suggested that one has to identify those learner misconceptions, provide explanations or activities that clear learner confusions and as such, learners would acquire new conceptions which do not conflict with scientific concepts. Involving learners in pair, group and class discussions to allow them to share their views and learn from each other was suggested as an important strategy to help learners understand new concepts by building up on what they already know.

The teachers' argument was that teaching strategies should not challenge learners' beliefs. They pointed out that learners are likely to make their own decisions based on the discussions and knowledge acquired thereof and not on the teacher's information. The teachers' suggestions closely resemble the constructivist view that when teaching, focus should be on continuing emphasising or building up on concepts that were previously ignored or underemphasised rather than replacing or discarding them (Smith III, DiSessa, & Roschelle, 1994). By employing constructivist teaching strategies the teachers view the learner as responsible and active in acquiring knowledge (Brooks & Brooks, 1999). To this end, Marlowe and Page (2005) emphasised the importance of teachers providing an enabling environment where learners are involved in critical questioning, problem solving and extensive reading. Learners' misconceptions in evolution would be addressed by eliciting, addressing and reconciling with previous knowledge. Adoption of sound pedagogical strategies is of utmost importance so that controversial topics such as evolution are presented in a scholarly manner rather than opposing religion (Woods & Scharmann, 2001). The teaching strategies that teachers pointed out are all constructivist in nature which, Deniz et al. (2008) regarded as emphasising knowledge construction and not take knowledge of evolution as a representation of reality.

A third of the teachers (mostly from the progressive group) admitted that they did not properly implement most of the strategies they mentioned in the interviews and as such, their learners maintained a poor understanding of evolution, which raises questions on whether teachers are fully prepared to teach evolution for meaningful understanding. It is important to note that teachers expressed their views based on their theoretical understanding of the pedagogical practices of teaching abstract and difficult concepts. It would have been more appropriate to observe the same teachers teaching the topic and assessing their pedagogical practices, rather than basing on what they said. Baxter and Lederman (1999) indicated that the assessment of teachers' practices has been shown to be very difficult as it requires a combination of approaches that can collect information about what teachers know, what teachers do, and the reasons for their actions. This is because teachers' actions are a more accurate representation of what they know and believe than the usual array of self-report measures (van Driel, Bijaard, & Verloop, 2001). Most importantly teachers cannot verbalise all of their practice; therefore what they know may be uncovered better from their performances than from what they say. In addition, what teachers say does not always reflect what they do. Therefore, a deeper understanding of teacher knowledge could be best achieved by observing them in teaching, as Borko and Putman (1996) alluded that teaching is contextualised and embedded in teachers' actions.

6. FUTURE RESEARCH DIRECTIONS

The findings of this study show that the topic of evolution does not receive adequate attention in the classroom in terms of meaningful teaching and coverage of important concepts despite the curriculum emphasis and stipulations. The following important questions therefore arise, which can inform future direction of research: Do teachers understand the nature of science because Lederman (1992) views the NOS as the cornerstone for effective teaching and learning of science as a subject? If they understand, how can they incorporate the tenets of the nature of science in teaching evolution for learner understanding? If they do not understand, how can pre-service and in-service teacher professional development programmes be structured to accommodate content on evolution, the tenets of the NOS, and their incorporation in science teaching? Based on the research findings, future research can extend the current study by observing teachers with different teaching philosophies whilst they teach different concepts on the theory of evolution. In doing so, the relationship between teacher beliefs and pedagogical practices can be ascertained better.

7. CONCLUSION

In this study teachers acknowledged the value of evolution as a key principle in Biology and were quite knowledgeable about the teaching strategies that are appropriate in teaching the concepts in a comprehensible manner. The teachers however, clearly indicated their inability to implement these teaching strategies in the science classroom particularly faced with learners from diverse socio-cultural and religious beliefs. As such, the 'conservative' teachers indicated that they utilised the transmission model of teaching (lecture method) where learners passively absorb what their teachers deliver about the theory of evolution with the hope that learners would regurgitate such information in examinations. On the other hand, 'progressive' teachers mentioned constructivist teaching strategies, which recognise the role learners' prior knowledge plays in constructing and understanding new knowledge. Examples include use of debates and argumentation, which invoke critical thinking in learners. Teachers indicated the importance of using open-ended questions in promoting learners to share their ideas and justify their viewpoints. The research findings inform teachers on some useful pedagogical knowledge and skills in terms of teaching strategies, activities and ways of introducing the topic that they can employ in teaching in order to enhance learner understanding of the concepts on the theory of evolution. They are also informed of some of the pitfalls and challenges associated with the teaching of this topic.

It can be concluded that teachers who lack understanding of NOS, experience difficulty in teaching the theory of evolution for scientific understanding because previous studies have found a correlation between understanding the NOS and acceptance of evolution. Because teachers determine the quality of classroom instruction, it is recommended that they possess a deeper knowledge of theory of evolution and also a repertoire of pedagogical strategies that make concepts more accessible to the learners for meaningful understanding. There is need for teacher professional development programmes to continuously develop teachers in terms of content and pedagogical skills as teachers can be constrained by their own personal belief systems, which may conflict with their understanding of the theory of evolution. Teacher educators need to provide continuous support to teachers even years after teachers have obtained their qualification to enhance continued professional development.

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KEY TERMS & DEFINITIONS

Grade 12 learners: These are students in their final year of high school in South Africa.

Life Sciences: The scientific study of living things from molecular to macro level and their interactions with one another and their environments.

Pedagogical practices: The methods, strategies, instructional approaches and/or styles of instruction and activities that teachers use to support learning.

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APPENDIX: SCENARIOS FOR TEACHER INTERVIEWS

Evolution is a controversial topic and it evokes mixed emotions in learners from diverse religious and socio-cultural background. Consider the practices of teachers A, B and C.

Teacher A: Today class we are going to visit memory lane, trace where you came from as a person, in other words I want you to draw your family tree based on the generation you have met.

Teacher B: Today as an introduction to the new topic on evolution, I want you to write down your views about the content of the topic theory of evolution and how it will help you as an individual and society in general.

Teacher C: Let us firstly watch a video clip of what happened on earth many centuries of years ago before we proceed to the new topic on evolution.

Interview schedule

1. What are your views about the content of the topic Theory of Evolution?
2. When teaching this topic, how do you normally introduce the topic?
3. What are some of the teaching activities that you engage your learners in?
4. Which questions do you ask to motivate learner participation?
5. What would you consider as the most appropriate teaching strategies and approaches when teaching this topic?
6. What are the challenges associated with teaching this topic?
7. How do you resolve these challenges?
8. If you were responsible for curriculum design, would you include this topic? Motivate your answer.

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Short biographical sketch: I am a Senior Lecturer in the Department of Science and Technology Education at the University of Johannesburg. I hold a PhD in Science Education from the University of Johannesburg, Master of Science Education Degree in Biology from the University of Zimbabwe, for which I was awarded two book prizes for the two years I studied. I also hold a Postgraduate Diploma in Science Education and a Bachelor of Education majoring in Biology from the University of Zimbabwe. I currently teach the undergraduate and postgraduate programmes. My research interests include socio-cultural perspectives in science education with a focus on social constructivist pedagogies and consideration of equity and diversity in making science content more comprehensible and relevant to learners. I am currently working on a project on indigenous knowledge, which envisages the provision of professional development to science teachers with knowledge, skills, tools and resources to implement multicultural science education.