

Lesson planning practices of South African Physical Sciences teachers in a new curriculum

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Abstract. This paper reports findings on the perceptions of South African Physical Sciences teachers on lesson planning. Significant changes to the school science curriculum require that teachers revisit how they plan lessons. We adopted a mixed method approach in collecting and analysing data from a large-scale survey of teachers through a structured questionnaire, and followed this with interviews with 10 teachers in seeking more in-depth explanations of the findings which emerged from the survey. The study revealed that when feasible, teachers work collaboratively in a community of practice when planning lessons. Apart from reducing the planning time, this strategy also leads to creative and innovative ideas that are shared. This is especially the case when teaching topics that are new in the curriculum and also lessons that are inquiry-based. Teachers also believe that writing a lesson plan does have pedagogical value because it serves as a support mechanism in planning deliberately for difficulties they encounter in addressing curriculum implementation challenges. The lesson plan therefore supports teachers in their role as reflective practitioners.

1. Introduction

The birth of a new democracy in 1994 in South Africa resulted in the need to transform the education landscape. A key goal in transforming the Apartheid education system was the need to provide quality education for all racial groups [1]. The new democratic South African government sought to develop and enact policies that sought to enhance the quality of school science education that was traditionally characterised by inequity. In particular, curriculum reform in Physical Sciences education was driven by the view that the previous curriculum was both inaccessible and irrelevant to historically disadvantaged black learners. In an attempt to address the above concerns and also the imbalances in the education system, a new outcomes-based curriculum was introduced in 1998. This curriculum advocates a learner-centred and activity-based approach to education [2]. This signalled a significant paradigm shift in the manner in which the learner was portrayed, as the previous curriculum was characterised by learner passivity and teacher-directedness.

In relation to Physical Sciences, curriculum planners were tasked with developing a curriculum with content that would be meaningful, accessible and relevant to all learners. This resulted in restructuring of the existing content and the addition of new topics. The planners were also faced with the demand of producing a curriculum which is more representative of the basic tenets of the nature of science such as the tentativeness of scientific knowledge and learners appreciating other systems of knowledge such as indigenous knowledge. Practical work in the school science curriculum is an area which received considerable attention in the curriculum reform initiatives which took place in South

Africa. Traditionally, practical work took the form of teacher demonstrations or embodied a “cookbook approach” in which learners follow recipes for the execution of procedures handed down by the teacher. The new curriculum advocates an inquiry-based approach to practical work that encourages learners on their own to explore objects, situations and events in their immediate environment, to collect data and record information and draw conclusions accurately [2]. These significant changes to the school science curriculum require teachers to revisit how they plan lessons.

2. Conceptualising lesson planning in science teaching

Lesson planning is widely regarded as being pivotal to effective curriculum delivery. Accordingly, it has been suggested that lesson plans serve as frameworks for conceptualizing, designing and delivering instruction [3]. A review of literature provides a compelling argument for teachers to engage in lesson planning. Lesson planning reminds the teacher of the specific goals to be achieved through classroom teaching and provides a picture of what is to be pursued and what is to be avoided [4]. In terms of the South African Physical Sciences Curriculum and Assessment Policy Statement (CAPS), such goals are expressed through specific aims, content specification and requirements for practical work [5]. Furthermore, a lesson plan is regarded as being essential to economize time and to make the teaching systematic and coherent [4].

The format of a lesson plan can vary. The dominant model for lesson planning is linear. It begins with the specification of objectives and ends with a lesson assessment. This rational approach to planning has been strongly influenced by instrumental interpretations of Tyler’s Basic Principles of Curriculum and Instruction [6] that regards the curriculum as comprising of planned learning experiences that are guided by intended learning outcomes and theorists such as Benjamin Bloom [7] who have developed taxonomies of learning [8]. Such a simplistic conception of lesson planning may reinforce views especially those of student teachers that teaching is the manifestation of classroom procedures [9]. Typically such a lesson plan grid will comprise of the following sections: topic; lesson outcome; specific aim; resources; teaching-learning activities; assessment opportunities and reflection. Such a format does not make explicit the internal logic that should guide prospective teachers in the way they think about conceptual progression, the conceptual relations within the knowledge field and what constitutes appropriate inquiry processes within a subject [9].

In view of the significant changes to the school science curriculum, this research investigated the perceptions and experiences of South African Physical sciences teachers on lesson planning. Accordingly, the following research question was formulated:

What are the perceptions and experiences of Physical Sciences teachers in planning lessons for a revised school science curriculum?

3. Methodology

The study employed a triangulation mixed methods design in which investigators collect both quantitative and qualitative data, merge the data, and use the results to best understand a research problem [10]. In this design, both qualitative and quantitative methods have equal status. Quantitative data was collected by means of a questionnaire that was administered to Physical Sciences teachers at various schools in the Gauteng Province of South Africa. The findings that emerged from the questionnaire analysis were then explored further by means of

interviews with a smaller sample of teachers. Figure 1 below depicts a visual representation of the research design used in this inquiry.

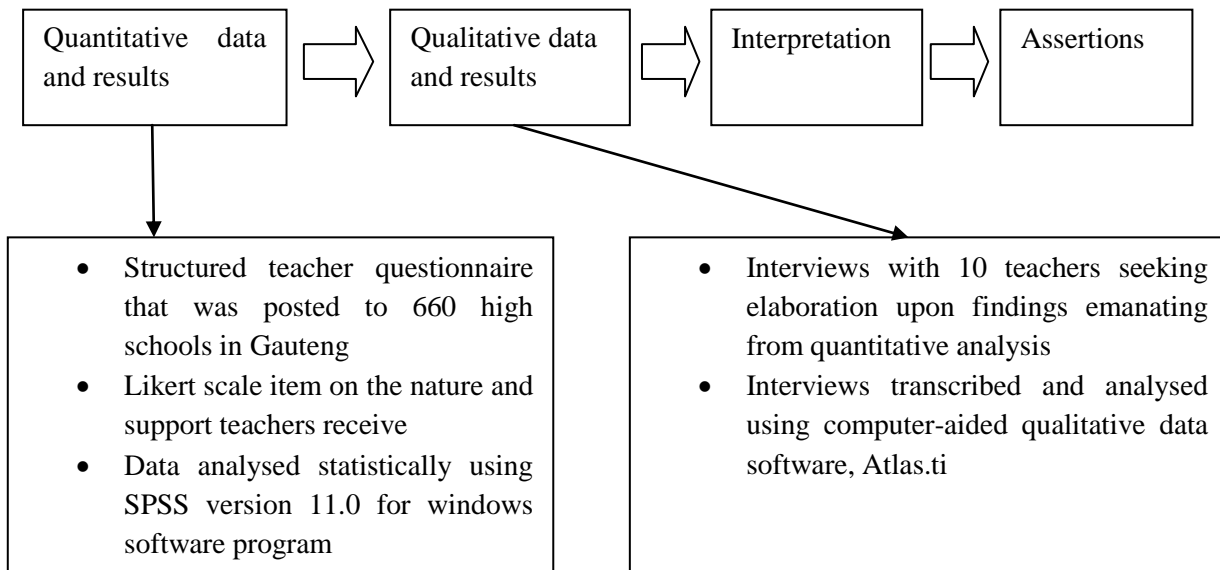


Figure 1: Visual representation of the research design used in this study

Quantitative data was collected by means of a structured questionnaire (Appendix A) that was posted to 660 high schools in the Gauteng Province of South Africa. Of the 660 questionnaires that were sent out, 263 questionnaires were returned. There was a reasonably large representation of respondents from suburban, township and city schools. In comparison, only a few teachers from rural schools responded. In developing the questionnaire items, we firstly conducted a focus group interview with 6 teachers. We were able to identify the core issues surrounding the implementation of the curriculum through this interview. The content validity of this questionnaire in terms of which items related to a particular aspect of curriculum implementation was established by having it reviewed by researchers in science education at three South African universities. The instrument was then field-tested with a group of teachers who were attending a professional development programme at a university. We asked them to identify and comment on items which were considered unclear or not readable. As a result of this feedback two items in the questionnaire were reworded.

Section A of the questionnaire sought information about the teacher such as the number of years teaching experience in Physical Sciences, teaching qualifications, professional development studies as well as information about the school such as location, annual school fees and the availability of resources. Sections B, C and D comprised Likert scale items all seeking data on teacher perceptions and experiences of teaching the new Physical Sciences curriculum. Section B comprised items relating to teacher perceptions of the new topics as well as the extent to which teachers collaborate with each other in overcoming challenges associated with the teaching of these topics. Section C related teacher planning and preparation as well as the extent to which teachers support each other. Section D focused on teacher perceptions of the curriculum reform in practical work and the collaboration between teachers in overcoming challenges related to curriculum reform. Sections B, C and D of the questionnaire contained statements to which teachers had to respond on a Likert scale

indicating the extent to which they agreed with the statement. In this paper we report only on the results yielded for section C.

Face-to-face interviews were conducted individually with 10 teachers from the sample of teachers who had filled in the questionnaire. These were teachers who had indicated on the questionnaire their willingness to be interviewed. In these interviews we sought more in-depth explanation of some of the findings which emerged from the questionnaire survey. Table 1 below provides a demographic description of each teacher in this sample.

Table 1: Demographic description of teachers interviewed

Teacher	Male/Female	Age	Qualifications	Type of school	Average class size	School resources
Teacher 1	Male	35	Teaching Diploma	Township school	47	Poorly resourced
Teacher 2	Female	44	Teaching Diploma	Township school	45	Poorly resourced
Teacher 3	Male	28	Education degree	Township school	46	Poorly resourced
Teacher 4	Male	37	Science degree	Township school	40	Poorly resourced
Teacher 5	Female	45	Education degree	Suburban school	32	Well resourced
Teacher 6	Male	34	Science degree; Teaching Diploma	Suburban school	29	Adequately resourced
Teacher 7	Male	43	Teaching Diploma	Suburban school	32	Adequately resourced
Teacher 8	Female	45	Education degree	Suburban school	34	Well resourced
Teacher 9	Female	34	Science degree; Teaching Diploma	Suburban school	29	Adequately resourced
Teacher 10	Female	43	Teaching Diploma	Suburban school	36	Adequately resourced

The responses to the questionnaire were analyzed statistically using the SPSS version 11.0 for windows software program. Frequency tables of data collected for Section A were generated. This enabled us to identify trends on teacher perceptions and experiences of lesson planning in teaching a revised Physical Sciences curriculum. The interviews were transcribed and analyzed using computer-aided qualitative data software, Atlas.ti. Data was then coded and classified, leading to the formulation of themes. This process was largely guided by the trends and patterns which had emerged from the analysis of the questionnaire data in relation to the teachers' perceptions and experiences of lesson planning.

4. Findings

The findings from the analysis of the survey were integrated with the findings from the teacher interviews into a coherent whole. This integration of quantitative and qualitative data supported the production of assertions in relation to teachers' perceptions and experiences of lesson planning in the implementation of a revised Physical Sciences curriculum.

Assertion 1:

Teachers view the lesson plan as a scaffold in addressing implementation challenges in teaching a new curriculum.

The great majority of teachers believe that lesson planning is important, especially in view of the new curriculum, with 76.2% of all teachers either agreeing or strongly agreeing that "Due to the newness of the curriculum all teachers should write lesson plans" (Item 7, Section C). In the interviews, teachers explained that a lesson plan served as a conceptual framework that enabled them to deliberately articulate their ideas on how they prepare their lessons to address changes to the curriculum. They mentioned in particular how the curriculum imperative for inquiry-based education meant that they had to plan activities that were directed at developing science process skills. This is evident in the following excerpts from the interviews:

I am starting to see some value in the lesson plan. Whereas before it was a monotonous thing to do because I was teaching the same topics over and over, now we are being asked to apply our minds. I can put all my ideas on the plan and then start to imagine how it unfolds.

Now the practical work is challenging to organize. The CAPS says let them investigate, and now we must try and organize it for them. I must think about a whole lot of issues, like what skills are being targeted and how to achieve it. I have a lesson plan grid I adapted that shows in time segments what they do and how I must help them.

Assertion 2:

In planning their lessons, teachers find it useful to work within a community of practice so that ideas can be shared, especially when teaching new content.

To a large extent, teachers find much value in working collaboratively when planning lessons. This was underlined in their responses to item 3, "When I am planning my lessons I find it useful to have a discussion with a colleague", in which 82% of teachers either agreed or strongly agreed with this statement. In these discussions, teachers exchange ideas on the most effective pedagogy to teach a particular topic. This was reflected in their responses to item 33 where 84% of all teachers either agreed or strongly agreed with "I exchange ideas with colleagues on how best to teach a topic". During interviews teachers elaborated as follows on this practice in lesson planning.

It is always useful to find a colleague who is teaching the same section and then we exchange our notes on it. I learn a lot from these meetings. Sometimes we are lost on the new topics and then I know a colleague can support me with something.

Teachers also explained that working within a community of practice enabled them to develop pedagogical strategies on how best to support learners when performing inquiry-based activities. A teacher mentioned that in inquiry-based learning, the teacher needed to redefine his role from that of a transmitter to a facilitator of learning. He explains as follows how interaction with a colleague from another school helped him acquire some understanding of what this role entailed.

The curriculum speaks of us facilitating learning when learners are busy with inquiry. I struggled with this and had no clue on what this meant. I then met another science teacher at a district and he sat with me and told me using some examples how I needed to plan my lessons. I found this to be enlightening.

Assertion 3:

Although teachers recognize the value of lesson planning, they bemoan the lack of time for it.

Due to the overwhelming demands of assessment requirements and the related marking associated with this, teachers struggle to find time to plan their lessons. In responding to item 13 “I wish I had more time available to plan my lessons”, 89% of teachers expressed the need for more time in planning. The teachers also highlighted that the demands of the new curriculum necessitated that they had to spend more time in planning their lessons. The following excerpts attest to this:

Where is the time for writing out a lesson plan? I spend more time both at school and at home sitting with portfolio files and assessment.

I wish I had more time in planning out my lessons. I try, but I get bogged down with other stuff like marking and so on. Also, planning a lesson is now no longer a 10 minute job. We have to be very direct on what is being taught and our approach in doing it. We must also think about assessment both formative and summative.

Assertion 4:

The teachers use the internet quite extensively in lesson planning.

Teachers maintain that the current set of school textbooks are inadequate in lesson planning, and they therefore sourced material from the internet. A large number of teachers made extensive use of the internet in seeking learner support materials. In fact, 65% of the teachers either agree or strongly agree with the statement “I make use of the internet to get ideas on teaching a new topic” (Item 15). They regard textbooks as lacking in learner support material that is sensitive to the cultural background of the learner, and they also regarded some of the activities presented as being far removed from the experiences of learners. Furthermore, they expressed the view that the current set of textbooks still promoted a didactic, teacher-centred approach to the curriculum imperative for inquiry-based learning. As a result, they had to search the internet websites such as Biological Sciences Curriculum Study (BSCS) for material that promoted an inquiry-based approach to teaching. The following excerpts reflect some of these views:

The textbooks we were asked to order do not have enough activities for learners to do for practical work according to inquiry-based approach. How should we cope now when the curriculum says teach inquiry? When I have time I try and make use of the internet education sites I can find.

All the learners have textbooks we handed out, but these books do not have what we want learners to do. They are still written in the old traditional style where we must be transmitting knowledge to them. How do I get them to explore something if there is nothing in the textbook? Fortunately with the internet I can google search some things that are relevant and current.

5. Discussion and conclusion

The research has revealed that teachers place much importance on lesson planning, and this is especially pronounced against the backdrop of significant curriculum reform that took place. Teachers believe that the process of engaging writing a lesson plan enables them to explicate their ideas on how the lesson should unfold. The lesson plan serves as a support mechanism in planning deliberately for difficulties they encounter in addressing curriculum implementation challenges. The teachers also indicated that if given the opportunity, they worked collaboratively with colleagues within a community of practice when planning lessons. In this community of practice they shared ideas on how to teach certain topics, especially those that were new in the curriculum, and this engagement enabled them to teach topics more effectively.

The teachers also highlighted the challenges they experience in providing inquiry-based lessons due to their lack of expertise and experience in this regard. Furthermore, they were quite reliant on colleagues for support and guidance when planning lessons. The teachers regarded the current set of textbooks as being inadequate in facilitating a learner-centred, constructivist approach which provides opportunities for learners to investigate their ideas practically. It was evident from the perceptions and experiences of teachers in lesson planning that the lesson plan is a mechanism through which ideas can be articulated on how learners can be supported in the construction of scientific knowledge. The conception of lesson planning that emerges from this research is one that goes beyond the dominant simplistic notion of a lesson plan being a linear and procedural manifestation of classroom procedures.

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Appendix A: Teacher questionnaire (Section C)

The following items relate to your *planning and preparation in Physical Sciences*.

Mark your response by placing a cross in the appropriate block.

		STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE	UNCERTAIN
1	Writing a lesson plan is useful in helping me think about the lesson I will teach	1	2	3	4	5
2	Only new teachers should write lesson plans	1	2	3	4	5
3	When I am planning my lessons I find it useful to have discussions with my colleagues	1	2	3	4	5
4	It is okay for teachers to deviate from their written lesson plans	1	2	3	4	5
5	If a teacher has taught for over 10 years he/she should not have to write a lesson plan	1	2	3	4	5
6	Due to the newness of the curriculum all teachers should write lesson plans	1	2	3	4	5
7	The curriculum documents from the Department of Education is useful in telling me about the depth at which I must teach a topic	1	2	3	4	5
8	I wish I could use a simpler grid to plan my lessons	1	2	3	4	5
9	Teachers should be allowed to design their own lesson plan grids according to their own needs	1	2	3	4	5
10	Any lesson plan should always have a learning outcome	1	2	3	4	5
11	I wish I had more time available to plan my lessons	1	2	3	4	5
12	When planning a lesson, it is necessary to have an assessment task in mind	1	2	3	4	5
13	I only write a lesson plan because it is checked by somebody	1	2	3	4	5
14	Due to the new curriculum, teachers should plan for more practical activities in their teaching	1	2	3	4	5
15	I feel isolated when planning my lessons	1	2	3	4	5
16	Lessons need to be planned so that learners are involved in some activity	1	2	3	4	5
17	It is important to use more than one textbook in planning lessons	1	2	3	4	5
18	The National Curriculum Statement is written in language which is easy to understand	1	2	3	4	5
		NEVER	SELDOM	SOMETI MES	OFTEN	VERY OFTEN
19	I find that I now spend more time planning for my lessons compared to the previous curriculum	1	2	3	4	5
20	I write a lesson plan	1	2	3	4	5
21	I plan my lessons so that learners from different ethnic backgrounds are	1	2	3	4	5

	considered					
		NEVER	SELDOM	SOMETI MES	OFTEN	VERY OFTEN
22	When planning my lesson, I deliberately search for challenging questions to ask my learners	1	2	3	4	5
23	I make use of the internet to get ideas on how to teach a topic	1	2	3	4	5
24	I follow a lesson plan grid which I received when I attended a Department of Education training workshop	1	2	3	4	5
25	I consult a variety of textbooks in planning my lessons	1	2	3	4	5
26	My lesson plan acts as a guide when I am teaching	1	2	3	4	5
27	When I plan my lessons I think about how my learners can be actively involved in the lesson	1	2	3	4	5
28	When planning my lesson, I consider a variety of questions at different levels of thinking to ask learners during the lesson	1	2	3	4	5
29	I use one textbook in planning my lessons	1	2	3	4	5
30	The Subject Assessment Guidelines helps me in developing appropriate assessment tasks for my learners	1	2	3	4	5
31	When planning to teach a certain topic I ask a teacher of another subject whether he/she is teaching something similar in his/her subject	1	2	3	4	5
32	When planning my lessons I look for examples which relate to the life experiences of my learners	1	2	3	4	5
33	I exchange ideas with colleagues on how best to teach a topic	1	2	3	4	5
34	The curriculum documents in Physical Sciences guide me in my lesson planning	1	2	3	4	5