

# Effective Use Of Discourse Patterns During Lessons On Topics Perceived To Be Difficult In Biology

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Kambi Manda

Mathematics and Science Education Department.

UNZA

Lusaka, Zambia

[Kambimanda@yahoo.com](mailto:Kambimanda@yahoo.com)

Haambokoma. C and Nachiyunde. K

Mathematics and Science Education Department.

UNZA

Lusaka, Zambia

[christopherhaambokoma@yahoo.com](mailto:christopherhaambokoma@yahoo.com) and  
[bungaman@live.jp](mailto:bungaman@live.jp)

**Abstract**— This paper explores classroom discourse patterns of lessons on topics perceived to be difficult in biology such as classification, mitosis and meiosis at senior secondary school level. A collective case study design was used and data were obtained from pupils and teachers using observation schedules and interview guides. Data collected were analysed using discourse analysis and thematic analysis. The study found that three discourse patterns are used by teachers when teaching topics perceived to be difficult in biology. These discourse patterns include teacher explanation discourse pattern, teacher led discourse pattern and pupil to pupil discourse pattern. The study revealed that effective teaching of topics perceived to be difficult in biology can only be realized when the following are considered during lessons: Motivation, incorporation of practical activities, use of a variety of teaching aids such as pictures and videos, giving a variety of examples, giving work to pupils to do outside the classroom and increasing time for questions. In view of the findings above, the following recommendations are made; Teachers should combine the three discourse patterns when teaching topics perceived to be difficult in biology. Teachers should avoid teaching using one discourse pattern when teaching topics perceived to be difficult in biology. Workshops and seminars should be organised for teachers in order for them to improve their skills on the use of these three discourse patterns.

**Key words:** Discourse patterns, classification, mitosis, meiosis, biological terms, cell division, practical activities, difficult topics.

## 1. INTRODUCTION

Although the general view is that biology is the easiest science subject to learn (Haambokoma, 2007). Examination results indicate that many candidates fail biology at the end of grade 12 (ECZ, 2016).

This countrywide underachievement of pupils in biology is not new. For example, in 2002 a total of 9975 (52.5%) pupils failed biology out of a total of 19000 registered candidates. In 2003 again 11890 (58%) pupils failed biology out of a total of 20500 registered candidates (ECZ, 2004).

One possible reason for this underachievement is that some pupils and teachers find some topics difficult to learn and teach respectively. According to the baseline study which was conducted by Haambokoma *et al* (2002), some topics were identified to be difficult to both teachers and pupils such as genetics, ecology, coordination and diversity of living organisms. However, classroom discourse patterns during lessons on topics perceived to be difficult have not been examined in Luapula province.

## 1.2 STATEMENT OF THE PROBLEM

Although researchers (Abimbola, 1998; Haambokoma, 2007; Cimer, 2012; Musonda,

2013; Chocha, Namayanga & Ndhlovu, 2014, Chifwa, 2015) have identified topics perceived to be difficult in biology, for teachers and learners, no studies have been conducted in Zambia to achieve knowledge and understanding of classroom discourse patterns during biology lessons on these perceived difficult topics in secondary schools in Luapula province. Hence there is no knowledge on this issue of classroom discourse patterns which needs investigation.

### 1.3 PURPOSE OF THE STUDY

The main purpose of this qualitative study was to explore classroom discourse patterns during lessons on topics perceived to be difficult in biology at senior secondary school level in selected secondary schools in Luapula province of Zambia.

### 1.4 RESEARCH OBJECTIVES

The objectives of the study were as follows:

1. To analyse the classroom discourse patterns during lessons involving topics perceived to be difficult.
2. To determine what could be done to improve the teaching and learning of topics perceived to be difficult in biology in order to facilitate pupils' understanding.
- 3.

### 1.5 RESEARCH QUESTIONS

The study was guided by the following questions:

1. How are the classroom discourse patterns like during lessons involving topics perceived to be difficult in biology?
2. What can be done to improve the teaching and learning of topics perceived to be difficult in biology in order to facilitate pupils' understanding?

## 2 METHODOLOGY

A qualitative research approach which focused on a collective case study was used in this study to acquire understanding of classroom discourse

patterns during lessons involving topics perceived to be difficult.

The study was conducted at 4 secondary schools in Luapula province which had poor school certificate results for 2015 and whose pseudo names and actual school certificate pass percentages are: Mango had 47%, Orange had 46.6%, Lemon had 42.8% and Apple had 41.3% (PEO Mansa, 2016).

The study population was all senior secondary school pupils learning biology and all teachers of biology.

At each school only 10 pupils were selected to participate in the focus group discussions of the study. This means that a total of 40 pupils participated in the study. A total of 11 teachers were selected from the four schools, three teachers from three schools and two teachers from one school. The sample size is usually small in a qualitative study (Merriam, 1998).

Senior secondary school pupils were selected using purposive sampling. Teachers of biology were selected on the basis of availability and willingness to participate in the study. Eleven Lessons observed were also purposively sampled. Semi-structured interview guides and lesson observation schedules were used to collect data. Data collection was preceded by a pilot study at Lubwe secondary school in Samfya District of Luapula Province to check on the suitability of research instruments and data collection procedures.

Trustworthiness was achieved through prolonged field work and recording interviews as well as filming lessons.

Data analysis took place concurrently with data collection as advised by Creswell (2003). Data collected from interviews was analysed using thematic analysis approach (Kombo & Tromp, 2006). Lesson observations were analysed using discourse analysis (Louis, Lawrence & Keith, 2000).

Ethical issues were put into consideration such as seeking permission from participants before recording interviews and filming lessons. In

addition, actual names of the participants and their schools have not been revealed in the report as recommended by Creswell (2003).

### 3. RESULTS

Findings of the study are presented according to the research questions. The first part gives the findings on the classroom discourse patterns during lessons involving topics perceived to be difficult in biology. The second part analyses what could be done to improve the teaching of perceived difficult topics in biology.

Thirty-three lessons were observed in this study out of which 11 were video recorded and transcribed but only two lessons were selected for this paper.

#### 3.1 Classroom discourse patterns during lessons involving topics perceived to be difficult in biology.

##### Lesson 1

The teacher's questions in this lesson required pupils to give a word or short sentence, which is not good for encouraging substantive student discourse in the classroom. The introductory part of the lesson took 10 minutes. The teacher took 80 minutes to conclude this lesson.

Below is an excerpt of the introduction to the lesson on one of the types of cell division known as Mitosis.

Teacher: *What is cell division?*

Pupil 1: *Cell Division is a process by which new cells are formed from already existing cells*

Teacher: *Can you mention the two types of cell division?*

Pupil 1: *Mitosis*

Pupil 2: *Meiosis*

Teacher: *What is Mitosis?*

Pupil 1: *Cell division which occurs in the body cells*

Teacher: *Others, what do you have to say?*

Pupil 3: *Two identical cells are produced from a zygote mother*

Teacher: *Others*

Pupil 4: *Mitosis is a type of cell division where 2 diploid and genetically identical cells are produced from one mother cell.*

The teacher was supposed to clearly guide the pupils to define mitosis as a type of cell division which takes place in all cells, except sex cells. The teacher should have asked pupils to explain that cells other than sex cells are called somatic cells. The teacher also forgot to emphasise that mitosis results in two cells that are identical to the original.

The next extract was the main body of the lesson and took about 60 minutes.

Teacher: *Mention 4 stages of mitosis*

Pupil 5: *Prophase*

Pupil 6: *Metaphase*

Pupil 7: *Anaphase*

Pupil 8: *Telophase*

After each response the teacher restated the answer in order to appreciate the pupils' responses and give a more acceptable version of the answer. The teacher divided the class into four groups to discuss stages of Mitosis. The teacher encouraged the pupils to use the books they had on their desks. After 10 minutes the teacher asked the group leaders to present their findings. During group work, the teacher was moving from one group to another facilitating the group discussions. Pupils were seen interacting with each other in the groups. During group discussions the teacher displayed charts showing different stages of mitosis.

A report from group 1 on prophase. Pupils were tasked to state what happens to the cell during prophase. The group representative stated the following statements from their discussion.

*The cell divides itself to perform its functions.*

*Chromosomes shorten and thicken to become visible.*

*Connected at the centromere, each chromosome is now seen to contain 2 strands.*

*Nuclear membrane and nucleus disappear marking the end of prophase.*

After this presentation the teacher extended the pupils presentations and guided the pupils in this group by saying that they were expected to report that during early prophase, the chromosomes become visible in the nucleus as the threads of the chromatin network become shorter and thicker. During late prophase, the chromatids become visible. They are held together by a centromere. The centrioles move to opposite ends of the cell and spindle fibres begin to form between them.

A report from group 2 on metaphase. Pupils were expected to explain what happens to the cell during Metaphase. The group representative said the following from their group discussion.

*The chromosomes line up along the equator.*

*The spindle fibres attach themselves to the centromere of the chromosomes.*

This group explained exactly what happens during metaphase because they were able to explain that chromosomes line up in the centre of the cell on an imaginary line called the equator and that chromosomes attach to the spindle fibres.

A report from group 3 on anaphase. Pupils were tasked to explain what happens to the cell during anaphase.

*Sister chromatids are separated from each other and pulled from each other.*

This group was supposed to show that during anaphase the spindle fibres contract and pull the chromatids towards the opposite ends of the cell called poles.

A report from group 4 on telophase. Pupils were expected to explain what happens to the cell during Telophase. The statements below were reported from the group discussions by the group representative.

*Chromatids reach the poles of the cells and align to form chromatin again.*

*Nuclear membrane reappears*

*Spindle fibres disappear.*

Pupils in this group were supposed to explain that during early telophase the chromatids reach the poles and a new nuclear membrane starts to form around them. Spindle fibres break down. The pupils were also supposed to show that during late telophase the chromatids are now called chromosomes and they unwind becoming long threads and finally each new nucleus contains chromosomes identical to the parent chromosomes.

The teacher restated and even extended group representatives' answers and explanations. This was done to encourage the pupils and motivate them. The teacher did not ask other pupils to react to their group representatives' presentations, because he wanted to save time.

The teacher described the stages of mitosis to help make statements very clear as follows;

Prophase stage

*Centrioles move to opposite poles.*

*Spindle fibres appear from centrioles.*

*Nuclear membrane and nucleolus disappear.*

*Chromosomes coil and shorten becoming visible.*

Metaphase stage

*Chromosomes line up along the equator.*

*Spindle fibres attach themselves to centromere of chromosomes.*

Anaphase stage

*Sister Chromatids are separated from each other and pulled to opposite poles, centromeres first.*

Telophase stage

*Chromatids reach the poles of the cell uncoil and lengthen to form chromatin again.*

*Spindle fibres disappear.*

*Nucleolus and Nuclear membrane reappear.*

The teacher should have guided the pupils to explain that the preparation for cell division occurs in a stage called interphase and that at the end of interphase the cell nucleus and cytoplasm

are ready to divide. However, the teacher ruled out the fact that mitosis starts with interphase and went on to emphasise that mitosis starts with prophase. This statement was not correct.

## *Importance of Mitosis*

In order to conclude the lesson, the teacher explained that mitosis is very important to living organisms. The extract below shows how the teacher concluded the lesson within 10 minutes.

Teacher: *Why is mitosis important to living organisms?*

Pupil 1: *It is needed for growth*

Teacher: *Another way in which mitosis is important to living organisms*

Pupil 2: *Replacement of cells*

Teacher: *Another way*

Pupil 3: *Asexual reproduction*

Pupil 4: *To maintain stability*

Pupil 5: *Regeneration*

Teacher: *What is regeneration?*

Pupil 6: *Continuity of the same characteristics of the cell.*

Pupil 7: *Regeneration is another type of asexual reproduction.*

Pupil 1: *Does mitosis occur in plants or Animals?*

Teacher: *It occurs in both plants and Animals.*

Pupils understood the importance of mitosis and this was seen from the number of participants who wanted to contribute when the teacher asked the class to state the importance of mitosis. The teacher concluded the lesson by restating the importance of mitosis to living organisms.

## **Lesson 2**

The next extract comes from the introductory part of one lesson on classification of living organisms which took about 6 minutes.

Teacher; *What is classification?*

Pupil 1; *Classification is an orderly grouping of organisms according to common features*

Teacher; *To which phylum does an earthworm belong?*

Pupil 2; *Nematoda*

Teacher: *No*

Pupil 3; *Oligochaeta*

Teacher: *No*

Pupil 4; *Annelida*

Teacher: *Yes*

The correct answer is Annelida. However, pupils find it confusing to state the correct phylum due to different classes and phyla.

The teacher rejected Nematoda because it is the phylum to which round worms belong. The teacher also rejected Oligochaeta because it is the class to which the earthworms belong.

From the lessons observed the study discovered that three discourse patterns are used by teachers of biology when teaching topics perceived to be difficult. These discourse patterns include: Teacher explanation discourse pattern, teacher led discourse and pupil to pupil discourse pattern. In the teacher led discourse pattern the predominant mode was Triple A which is ask, answer, accept and double A and then R which is ask, answer, reject.

## **3.2. What can be done to improve the teaching of topics perceived to be difficult in biology in order to facilitate pupils' understanding?**

There are several ways of improving the teaching of topics perceived to be difficult in order to facilitate pupils' understanding. This is what respondents said could improve the teaching of topics perceived to be difficult in biology.

### **3.2.1 Motivation**

Some respondents proposed that there was need to develop interest in pupils in topics perceived to be challenging to learn, this was shown by one teacher who said that;

*Pupils can only learn effectively if they are motivated to learn. Very little learning can occur if pupils are not motivated.*

Motivation is the most important factor that teachers should target in order to improve

learning. When pupils are motivated they pay attention, they begin working on tasks and even ask questions.

### 3.2.2 Incorporation of practical activities

Some respondents suggested that lessons perceived to be difficult should include practical activities. This was observed by one teacher who said that:

*I would make it more practical and allow pupils to make models of cells at each stage using plain papers, cotton threads and glue. I would also use videos on mitosis if found.*

### 3.2.3 Use of a variety of teaching aids

Some teachers supported the use of different teaching aids as was reported by one teacher who said that:

*There was need to bring more teaching aids for pupils to see*

Another teacher who was in support of the teaching aids also had this to say:

*I would provide more charts and also put pupils in pairs to avoid a lot of pupils using one chart.*

One teacher regretted having taught a lesson without practical examples and he had this to say:

*I should have improved my lesson by providing good practical examples.*

### 3.2.4 Use of pictures and videos

Other teachers supported the use of pictures and videos during lessons involving mitosis and meiosis. One teacher had this to say:

*I would make sure that each pupil has a picture showing all the stages of mitosis.*

The use of power point presentations was also mentioned by teachers and one had this to say:

*I would give the pupils power point presentations on mitosis and meiosis because it was difficult for me to draw diagrams on the board.*

### 3.2.5 Use of worksheets

Other suggestions which came out from the teachers on the improvement of the teaching of topics perceived to be difficult in biology included the use of work sheets. One teacher had this to say:

*I should prepare worksheets and reduce on the number of pupils in groups.*

Pupils also echoed the use of videos in lessons. This came to light when one pupil said that:

*We need to have videos of mitosis and not just stationery pictures*

### 3.2.6 Use of practical work

Other pupils emphasised the use of practical work. This was reported by one pupil who said that:

*We need more practical work and more specimens in our groups for us to see.*

This idea was supported by another pupil who said that:

*The groups should be reduced and more work sheets given to pupils.*

One pupil was more particular with the diagrams drawn by teachers and had this to say:

*Teachers must draw diagrams properly on mitosis which they give us in our groups to discuss.*

### 3.2.7 Need for field trips

Classification is more interesting when it is taught outside the classroom right among the organisms.

This was reported by one pupil who said that:

*We need to go out in the environment and watch for ourselves the feature of living organisms not just listening from our teacher.*

Another pupil had this to say:

*The teacher should bring real organisms to show us in the classroom during lessons on classification of living organisms.*

## 4.2.8 Giving a variety of examples

One pupil thought that the teacher brought out a lot of examples on classification of living organisms and had this to say:

*The teacher should consider using only a manageable number of examples so that we can have time to master them rather than giving us a lot of examples on classification of living organisms. This tends to confuse us.*

## 4.2.9 Provide more time

Some pupils wanted more time to be allocated to the teaching of cell division. One pupil had this to say:

*I need a lot of time just learning this topic for me to understand. This topic of mitosis is very challenging to me so the teacher should spend some good time teaching this topic.*

This idea was also supported by another pupil who said that:

*Mitosis should be taught more than once. The teacher should teach this topic again for some of us to understand.*

## 4.2.10 Give work to pupils to do outside lessons

Some pupils were in support of the homework policy and one pupil had this to say:

*The teacher should give us this work so that we go and do it from home and then we come and present our findings to our friends.*

Another pupil had this to say on homework:

*The teacher should just give me an assignment so that I can do research on my own.*

## 4.2.11 Peer teaching

Other pupils wanted their fellow pupils to explain to them some difficult aspects of the topic and one pupil had this to say:

*I will be able to understand if my fellow pupil explains to me. I failed to understand the terms which the teacher was using.*

This was supported by another pupil who said that:

*I need somebody who has understood this topic to teach me*

When asked how best they could learn mitosis some pupils suggested that they wanted discussions amongst themselves and one pupil had this to say:

*We can only learn mitosis properly through discussions among ourselves.*

## 3.2.12 Changing of teachers

One pupil thought that they were so many in the classroom and had this to say:

*Learning can only improve in this class by reducing the number of pupils and also by changing the teacher.*

Some pupils were not comfortable with their teachers. However, one pupil who was against changing the teacher had this to say:

*We as pupils we need to concentrate very much as the teacher is teaching we need to pay attention. We should not only blame the teacher for not understanding what he is teaching.*

## 3.2.13 Increase time for questions

When one teacher was asked on how he would improve his lessons said that:

*I would give them more time to ask questions about the topic as well as giving them work cards instead of writing on the board.*

This simply indicates that teachers do not give their pupils chance to ask questions where they are not clear.

## 4. DISCUSSION

### 4.1 Discussion on discourse patterns used during lessons on topics perceived to be difficult in biology

The discourse analysis of the teaching suggests that all 11 lessons were conducted through teacher-led discourse, where teacher explanation and interrogations of the pupils' knowledge and understanding was the most common form of classroom interaction.

The excerpts reveal the extent to which the classroom discourse is made up of teacher explanation and question and answer sequences. Individual pupils do not usually volunteer for turns but are called on by the teacher where the pupil stands up to answer. Choral responses to questions are common and are often used to reinforce information given by the teacher or elicited from the pupils. The lack of an explicit feedback move prohibits any systematic building on pupils' answers that are often limited to a few words.

Because of the dominance of whole class teaching, tasks were usually undifferentiated in respect of ability and the teacher monitored mostly from the front. Pupils spent a great deal of time, over 30 per cent of the lesson, listening to the teacher explaining. Teachers would often ask closed-ended questions requiring recall and the response of a single word. Such questioning and pupils answering took up nearly 50 per cent of the lesson time.

Teacher feedback on responses was rare even where individual pupils were concerned, offering few opportunities for ideas to be developed or examined from other angles. In the case of an individual answering, pupils did not bid to answers but were nominated by the teacher. Teachers would also ask questions and provide an answer, thereby further closing down opportunities for more exploratory forms of questioning.

Introductions and conclusions were instructional but always very brief. Central sections were usually combining direct instruction with short periods of question and answer. The lessons appeared going over previously taught material, rather than developmental in nature to ensure progression in learning. Most of the learning tasks

put a strong emphasis on factual, propositional knowledge (knowing that) rather than procedural knowledge (knowing how).

It was also apparent from the video evidence that the quality of the classroom interaction was hampered by the lack of teaching resources and textbooks in many of the classrooms. Better quality teaching aids and textbooks would promote more active forms of learning. There was also very little pupil-pupil discussion or collaboration, except when pupils voluntarily helped each other. Breaks in this pattern occurred when children were called to the front of the classroom, singly, in pairs or as a group, to work at the chalkboard or recite. Pupil presentation took up nearly 10 per cent of the lesson time. Teachers also moved relatively little, remaining at the front of the room for most of each lesson and occasionally venturing between rows to monitor written work.

## **4.2 Discussion on proposals for improving learning of some topics perceived to be difficult in biology**

Evidence from the findings indicated that without motivation from the teachers to the pupils effective learning cannot take place. A motivated class even participates in the lesson by answering as well as asking questions. This promotes pupil understanding of the perceived difficult topics in biology.

Findings indicated that for a lesson to be successful it must incorporate the practical component. Teachers should make available models made out of simple materials. Teachers sometimes fails to improvise teaching aids and models when they can easily make their own and make teaching interesting.

The use of pictures and videos was supported by both teachers and pupils. Other teachers even hoped to use power point presentations during their lessons to get the attention of pupils. Some pupils were even against stationery pictures and



wanted moving pictures such as short documentaries of mitosis and meiosis.

Some teachers indicated that charts were supposed to be distributed to pairs of pupils so that there is no congestion on the points where charts have been stuck. In addition, others thought that groups should be reduced and then worksheets distributed to the groups of pupils.

Pupils wanted field trips to be incorporated into their lessons they indicated that they wanted to go out into the natural environment and watch for themselves different types of living organisms in their habitats. Pupils revealed that they were tired of listening to their teachers' explanations. Others advised that teachers should struggle to bring some organisms to class to show them.

Too much work in a short period of time was one of the concerns raised by pupils. They thought that the teacher offloaded a lot of examples in a short time thereby making it difficult for them to remember something. Another alternative which came from the pupils was that there was need to give a lot of time to these topics of mitosis and meiosis. Pupils wanted their teachers to spend a lot of time of these perceived difficult topics. Some pupils believed that for them to understand the topic the teacher should teach more than once.

This confirms findings from Reece and Walker (1997) who argued that when lessons are presented in a very fast manner, pupils fail to follow the lesson therefore learning cannot take place. Usually many teachers of biology would like to present lessons very fast so that they can cover the wide biology syllabus.

Findings of the present study have shown that pupils were in favour of the homework policy. Others wanted teachers to give them work which they could study at home and then get to class and present their answers to their friends. Some pupils indicated that they needed their teachers to provide work which they could do at home and do research on their own.

Still some pupils maintained that they would only understand classification of living organisms if they listen to their fellow pupils explain the topic

to them. Pupils really expected their fellow pupils to teach them after the teacher had taught the lesson. Pupil discussions were very much liked by the pupils because they were expecting to get a lot of information from their friends. Slower learners benefited very much because they were able to seek clarification from their peers.

Other pupils suggested the reduction of the number of pupils in their classes. They thought that they were unable to learn properly due to the congestion in their classrooms. Other pupils suggested changing their teachers. However, to the contrary some pupils who never wanted changing of teachers suggested that as pupils they were expected to pay attention during lessons and not just blame the teachers for not understanding the lesson.

Some teachers suggested that they needed to give pupils more time to ask questions and seek clarification on issues where they were not clear. This corroborates with Beccles (2012) who advised that teachers need to use questions to elicit student thinking, regularly invite questions from students and encourage responses from students. Beccles further advised that teacher questions need to stress remember, understand, apply, analyse, evaluate and create cognitive processes as well as factual, conceptual, procedural information and meta-cognitive knowledge dimensions. Beccles observed that the quality of student's answers and thinking is a reflection of teacher questions, therefore, the cognitive processes and knowledge dimensions need to be appropriately stressed. It was also suggested that work cards be given to pupils instead of teachers giving work to pupils on the board.

## 5. Conclusion

The study has revealed discourse patterns used by teachers when teaching aspects of classification, mitosis and meiosis. The findings of the study indicated that teachers proposed that the practical component should be incorporated in the lessons by either improvising teaching aids or models in

order to make the lessons interesting. Pupils and teachers advocated for the use of pictures and videos on mitosis and meiosis. It was clear from the findings that pupils wanted classification of living organisms to be taught through field trips where they would come into contact with the environment.

The study revealed that pupils supported the use of homework and group discussions because they were free to consult their friends in groups as well as at home.

The study discovered that teachers were rushing to finish the syllabus due to the bulk biology content. Therefore, it was suggested the biology content should be restructured so that other contents are removed in order to reduce pressure on teachers who teach at a rapid rate to cover the wide syllabus on time. It is believed that reduced content may motivate teachers to use more effective teaching methods.

Findings indicated that teachers were expected to start lessons with an interesting, real-life story or question. Since genetics is a crucial field to any aspiring biologist, instead of starting your lecture with another textbook definition or diagram, start with a story or question.

Framing your lecture around a real-life question sets the tone for research and experiments that lead to science-supported conclusions in concrete contexts in the real-life big picture.

In view of the findings above, the following recommendations are made; teachers should combine the three discourse patterns namely teacher explanation, teacher led and pupil to pupil discourse patterns when teaching biology because these patterns proved effective when used together. Teachers should avoid using one discourse pattern during lessons on topics perceived to be difficult. Workshops and seminars should be organised for teachers to enable them acquire skills of teacher explanation, teacher led and pupil to pupil discourse patterns for teaching

biology. Biological terms must be explained to pupils in a clear way by using the teacher explanation discourse pattern. Pupils should be encouraged to draw diagrams on cell division during pupil to pupil discourse pattern. Teachers must use real life examples of living organisms to help classify them into different kingdoms, phyla/divisions, classes, orders, families, genus and species during the teacher led discourse pattern.

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