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## Evaluation of student-teacher questions: A study of pedagogical practices relating to proportions and rate per-minute of questions asked in physical education class setting

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### Abstract

Questioning is one of the pedagogical strategies that ensures that students appropriately engage in relevant activities in teaching and learning environment. Questioning plays a critical role in refreshing memories of learners on their previously acquired knowledge or in the acquisition of new knowledge while a lesson is in progress. Regular questioning of students is a good practice to help learners think for themselves instead of being “spoon-fed” by the teacher. However, over concentration on lower-order questions has a dire consequence on the thinking skills of students. In this study, we used a descriptive approach to examine proportions and rate per minute of questions that occurred in a theory physical education (PE) lesson. The study involved a class of 38 students of a College of Education and one teacher (intern) of a University in Ghana. The PE lesson was video-recorded. Self-developed event recording instrument was used to collect data on questioning behaviours of both the teacher and students. Data collection instrument was validated by an expert in research (senior university faculty). Descriptively, data were analysed and presented in tables and figures. Intra-observer results of classroom events relating to questioning behaviours of the teacher and students were evaluated. Findings revealed that the proportion of lower-order questions was generally larger than higher-order questions that occurred during the lesson. Findings also showed that a total of 36 questions were asked by the teacher during the 35 minutes interaction. Specifically, the rate per minute of questions asked by the teacher at various question levels was 0.38 for knowledge, 0.35 for understanding, 0.2 for synthesis, 0.25 for evaluation, and zero for application and analysis questions. No question was asked by any of the students in the entire 35 lesson duration. We recommend that teachers should make conscious efforts to create opportunities for learners to ask questions in every teaching and learning environment.

**Keywords:** questioning behaviour, higher-order thinking, lower-order thinking

### Introduction

Effective teaching and learning environment involves the ability of the teacher to use a good questioning strategy. A good questioning behaviour has to be developed and practiced in the same way as other teaching strategies. Research suggests that questioning can yield positive effect on students' interaction in their learning process (Phan & Nguyen, 2021) [15]. Proper questioning strategy can make it easier for teachers to get feedback from learners, increase students ability to think critically and creatively and make students pay attention in the classroom (Shanmugavelu, 2020) [16]. Teachers must identify the use of questions as an instructional format in which tasks can be communicated to students and guide students' activity toward instructional goals.

Often, a lesson is incomplete without questioning students or offering the students the opportunity to question the teacher. For effective lesson delivery, teachers must outline questions that they intend to ask and when they would allow students to ask questions. Questioning should be seen as a shared responsibility between the teacher and the students.

Literature indicates that learning is no longer teacher's responsibility but a shared responsibility of both the teacher and students (Belmekki, 2021)<sup>[5]</sup>.

From literature point of view, almost every instruction involves the use of questioning (Marquardt, 2011)<sup>[12]</sup>. This is due to the fact that questions are powerful means to arouse students' curiosity in the lesson. In fact, one of the characteristics of good teaching is to give students the opportunity to question the teacher. This makes the use of questions a two-way affair rather than a monopoly by the teacher. Effective teachers use a variety of pedagogical skills and strategies to ensure that students are appropriately engaged in relevant activities. It is important to note that most effective lessons are those in which teachers have high expectations to offer their students clear instructions that identify specific learning targets.

Research has revealed that questions can be used strategically to engage students in active participation in the learning process (Long & Blankenburg, 2015)<sup>[11]</sup>, keep students interest (Hannel, 2009)<sup>[9]</sup>, and monitor progress in students understanding (Tofade *et al.*, 2013)<sup>[19]</sup>. To trigger students' curiosity to ask questions, teachers can integrate question and answer session into the lesson delivery process. This way, students could be paired or grouped to perform questioning tasks based on the subject matter. Literature suggests that questioning is among the social competencies that children bring to class (Amalia & Devanti, 2016)<sup>[4]</sup>. Equipped with this information, lesson delivery should move from teacher-focused to student focused which implies new perspective or approach to questioning in class setting (Almeida, 2012)<sup>[2]</sup>.

Effective teachers demonstrate ability to ask questions consistently in line with instructional goals. Every teaching must be effective. For this reason, teachers must be concerned with the quality of questions they ask in teaching and learning environment. To become effective in the classroom requires that teachers possess sufficient knowledge in the subject matter including the kind of questions to ask students. As a potential tool that facilitates students' learning, questions posed during lesson delivery must lead to higher-order thinking or must improve students' competence greatly. However, many studies that focused on judging the quality of questions asked in classroom situation suggest that most questions fail to engage students critically with the content (McQueen, *et al.*, 2014)<sup>[13]</sup> and that instructors target the lowest level questions (Momsen, 2010)<sup>[14]</sup>. It is also reported that a high proportion of questions posed by the teacher fall in the lowest two levels (Zheng *et al.*, 2008)<sup>[21]</sup> and that teachers ask typically low questions that require mainly recall of information (Albergaria-Almeida, 2010; Gort *et al.*, 2012)<sup>[1, 8]</sup>.

Notably, questioning has been an integral part of teaching and learning process. However, over concentration on lower-order questions has a dire consequence on the thinking skills of students. Effective teaching is best evaluated by observation of students, their work involvement process and what they achieve. In this study, we observed a video-recorded lesson of students and a teacher. Specifically, we concentrated on proportions and rate per minute of questions asked in a 35-minute class period.

## 2. Materials and Methods

### 2.1 Study Design

A case study was designed for the investigation. The entire class was regarded as a small social unit that provided rich information for the study. In the process, a theory lesson was

video-recorded in teaching and learning situation. The study was meant to provide insight into the proportions and rate per minute of questions asked in a typical physical education theory class setting. The use of case study design allowed in-depth analysis of teacher-student questioning behaviours in real classroom situation.

### 2.2 Population and Sampling

Participants in the study included second year students of a college of education in Ghana and one teacher (intern) of a university. One video-recorded lesson was randomly selected from over 40 video-recorded lessons. All students who took part in the lesson were automatic participants for the study. In all, there were 39 study participants (students=38, teacher=1).

### 2.3 Data Collection and Analyses

The main instrument used for data collection was self-developed event recording instrument named "Teacher & Students Questioning Behavior Instrument (TSQBI)". It was validated by an expert in research (senior university faculty). By this approach, the instrument was submitted to a professor in physical education who inspected and ascertained its capability for collecting accurate, valid, and reliable data. According to Siedentop and Tannehill (2000)<sup>[18]</sup>, instrument of this kind should be systematic, easy to use and capable of recording accurate data on teacher behaviours that could be defined and measured. The TSQBI enabled a frequency tally of teacher-students questioning behaviours from a video tape. Teacher questioning behaviour rubrics were based on taxonomy of educational objectives (Bloom, *et al.*, 1956)<sup>[6]</sup>.

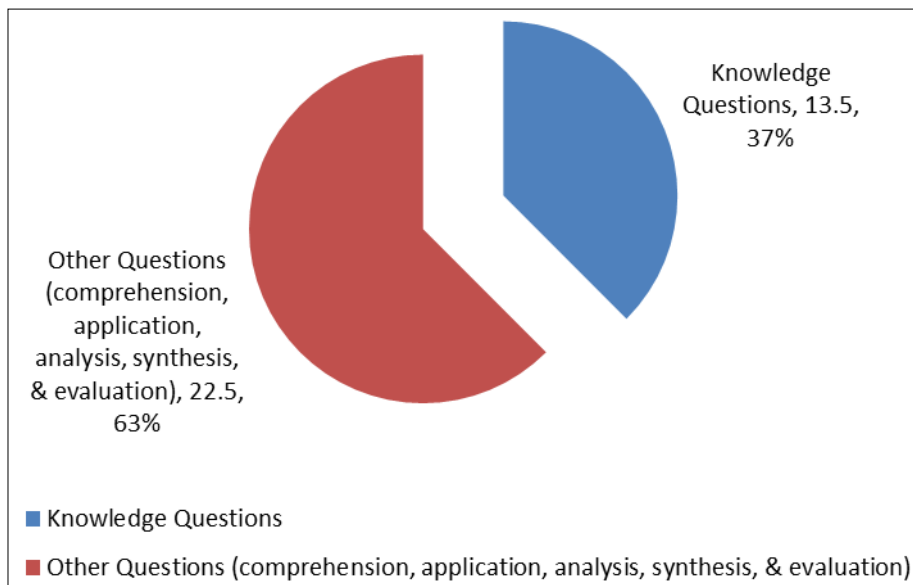
An experienced PE teacher engaged in two separate observations of the same content of video-recorded lesson with two weeks interval between the first and second observations. The two weeks interval was enough to avoid interference with previously observed data. Generally, the use of event recording format is reliable and good for research and situations that relates to behaviour that occur frequently and quickly. One advantage of event recording instrument is that data generated from it can be converted into percentages, rates per minute, proportions, etc. Event recording for research purposes enables meaningful graphical representation of data. With event recording format, intra-observer/rater or inter-observer/rater agreement checks can be carried out to ensure that data generated using the instrument is reliable. In this case, intra-observer/rate or inter-observer/agreement (IOA/IRA) of at least 80% is required to establish a good reliability of data. Literature supports the 80% requirement for establishing reliability for data generated via event recording instrument (Siedentop & Tannehill, 2000)<sup>[18]</sup>. In the current study, intra-observer data collection method was utilized to document teacher-student questioning behaviours from the vide-recorded lesson. Main categories of observed data included question level as established in the original work of Bloom *et al.* (1956)<sup>[6]</sup>. These levels of educational objectives established by Bloom and his associates are: knowledge, understanding, application, analysis, synthesis and evaluation. Frequency count of questions asked by students and the teacher were analyzed descriptively and represented in graphical and tabular formats. Finally, all questions in the entire lesson were converted into rate per minute. This helped to describe the rate at which questions were posed in a typical PE class setting. Basically, statistical analysis of data involved frequencies, means, proportions and rate per minute of questions in observation 1 and 2 as presented in table 1.

**3. Results**

**3.1 Proportion of Knowledge Questions in Relation to Other Questions**

Intra-observer data revealed that 37% of the questions (n=13.50) asked by the teacher were knowledge level

questions with other levels of questions constituting 63% (n=22.50). Figure 1 presents a pictorial description of the proportion of knowledge questions in relation to other questions that were produced by the teacher in the entire 35 minutes lesson.

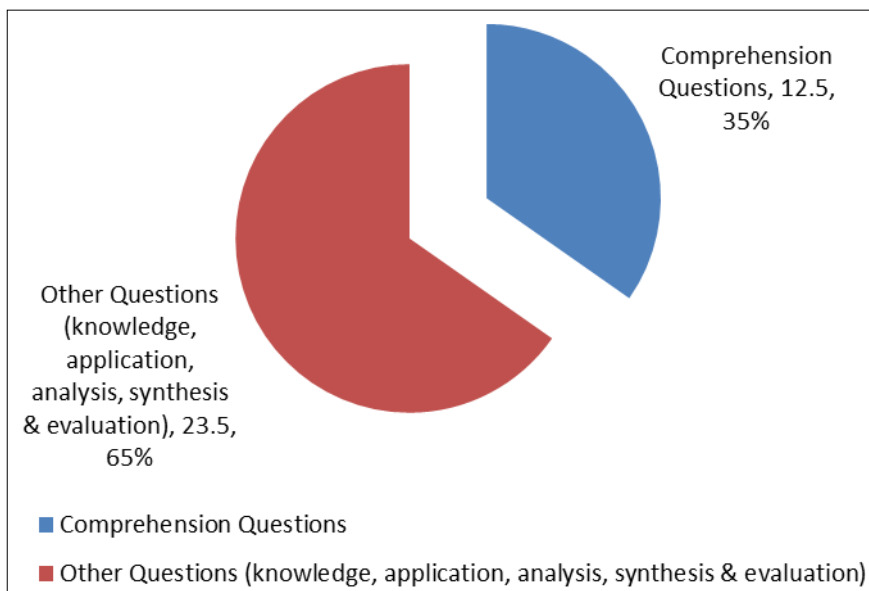


**Fig 1:** Proportion of knowledge questions in relation to all other questions

**3.2 Proportion of Comprehension Questions in Relation to Other Questions**

Intra-observer data revealed that 35% of the questions (n=12.50) asked by the teacher were at the level of understanding. The rest of the question levels formed 65%

(n=23.50). Figure 2 presents a pictorial description of the proportion of comprehension questions in relation to other questions that were produced by the teacher in the entire 35 minutes lesson.

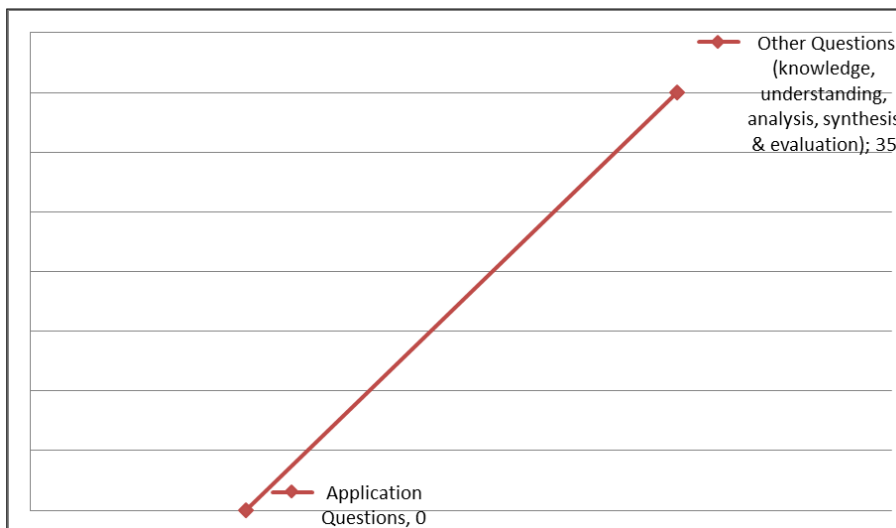


**Fig 2:** Proportion of Comprehension questions in relation to all other questions

**3.3 Proportion of Application Questions in Relation to Other Questions**

According to the intra-observer data, none of the questions asked by the teacher related to application level. Figure 3

presents a pictorial description of the proportion of application questions in relation to other questions that were produced by the teacher in the entire 35 minutes lesson.

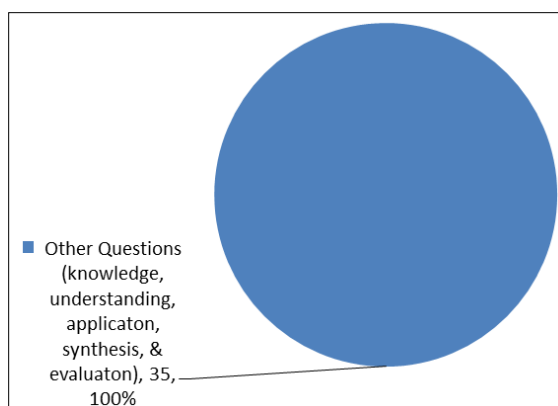


**Fig 3:** Proportion of application questions in relation to all other questions

**3.4 Proportion of Analysis Questions in Relation to Other Questions**

According to the intra-observer data, none of the questions asked by the teacher related to analysis level. Figure 4

presents a pictorial description of the proportion of synthesis questions in relation to other questions that were produced by the teacher in the entire 35 minutes lesson.

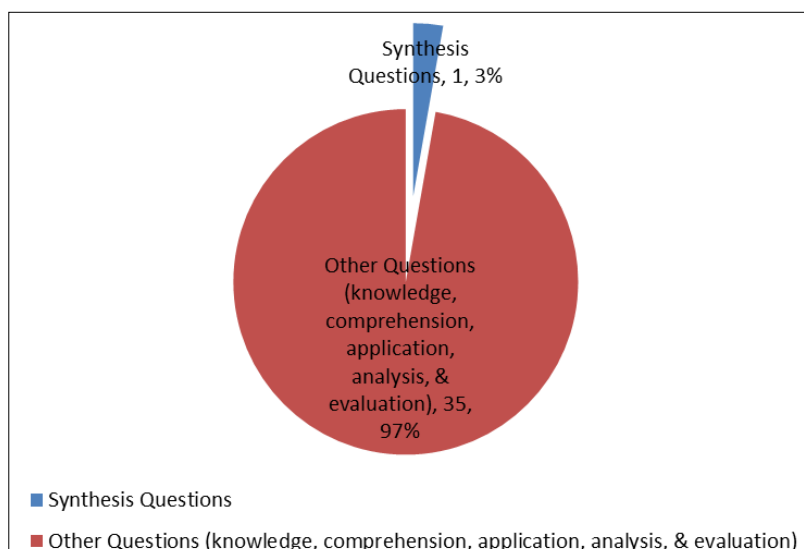


**Fig 4:** Proportion of analysis questions in relation to all other questions

**3.5 Proportion of Synthesis Questions in Relation to Other Questions**

Intra-observer evaluation of data shows that only 3% of the questions (n=1) asked by teacher related to synthesis level,

while the rest of the levels formed 97% (n=35). Figure 5 presents a pictorial description of the proportion of synthesis questions in relation to other questions that were produced by the teacher in the entire 35 minutes lesson.

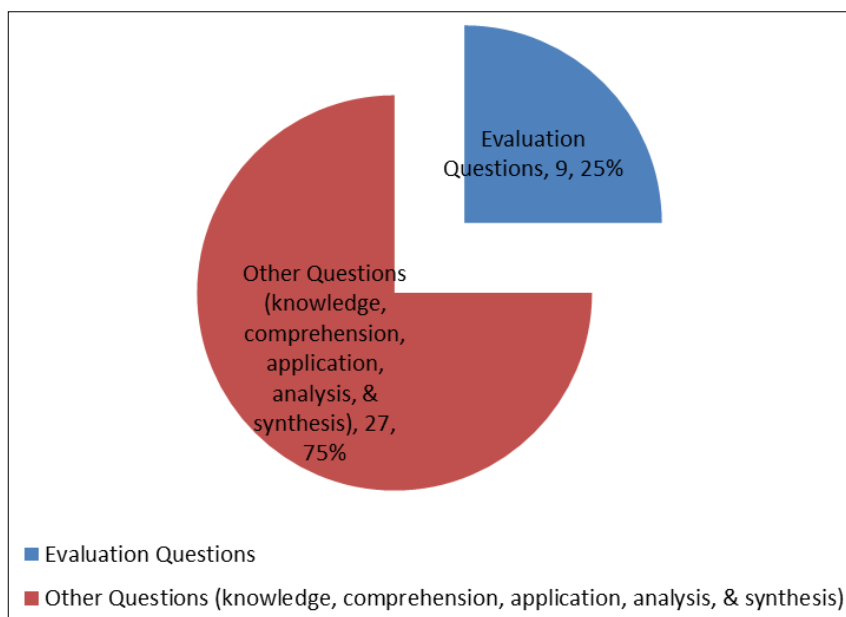


**Fig 5:** Proportion of synthesis questions in relation to all other questions

### 3.6 Proportion of Evaluation Questions in Relation to Other Questions

According to intra-observer data, 25% of the questions (n=9) asked by the teacher related to evaluation level, while the rest

of the levels formed 75% (n=27). Figure 6 presents a pictorial description of the proportion of evaluation questions in relation to other questions that were produced by the teacher in the entire 35 minutes lesson.

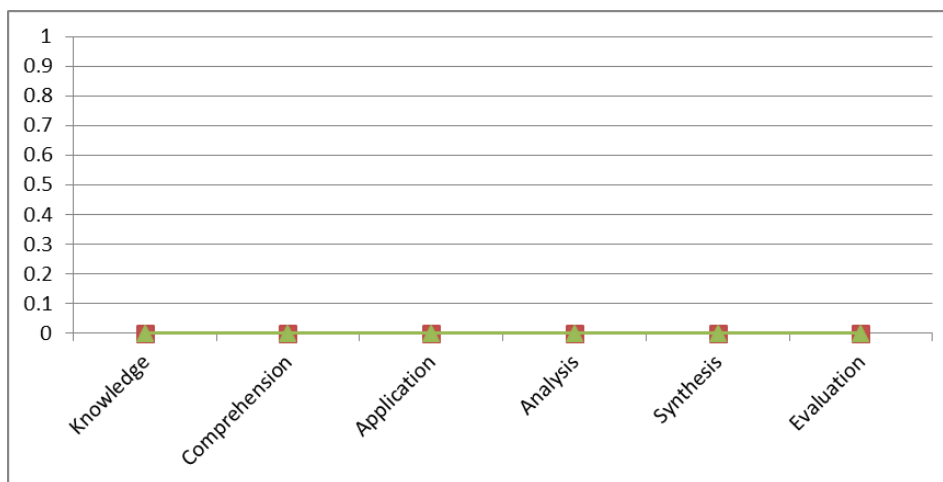


**Fig 6:** Proportion of evaluation questions in relation to all other questions

### 3.7 Students' Questioning Behaviours

Unusually, students did not ask any questions in the entire 35 minutes lesson. Diagrammatic representation of the

questioning behaviors presented in the graphs was therefore zero as shown in figure 7.



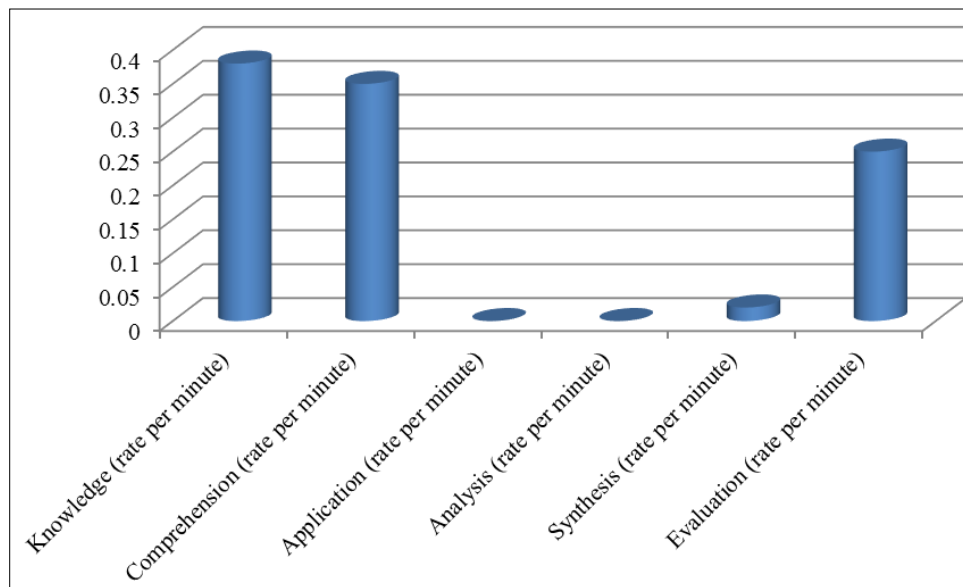
**Fig 7:** Question levels by the students

Each question level was calculated in frequency and converted to rate per minute. Intra-observer evaluation of data shows that the rate per minute of questions asked by the teacher was 0.38 for knowledge, 0.35 for understanding, 0.2 for synthesis, 0.25 for evaluation, and nothing for application

and analysis questions. However, putting together all the levels of questions, the rate at which questions were asked by the teacher was one question per minute. These results are presented in table 1 with graphical representation of data in figure 8.

**Table 1:** Rate per Minute of Questions Asked by the Teacher, (Lesson duration = 35 minutes)

Level of Questions (Quality)	Observation One (f)	Observation Two (f)	Intra-Observer Mean Scores	Rate Per Minute	
				Equation	Total
Knowledge (Recall)	12	15	13.50	13.50/35	0.38
Comprehension	13	12	12.50	12.50/35	0.35
Application	0	0	0	0/35	0
Analysis	0	0	0	0/35	0
Synthesis	1	1	1	1/35	0.02
Evaluation	9	9	9	9/35	0.25
Total	35	37	36	36/35	1.03



**Fig 8:** Graphical representation of rate per minute of question levels by the teacher

#### 4. Discussion

The purpose of the study was to investigate proportions and rate per minute of questions that occurred in a typical physical education theory lesson between students and the teacher. Findings indicated that the proportion of lower-order questions was generally larger than higher-order questions during lesson delivery. In similar studies, it is noted that “Teachers ask typically low level questions, requiring mainly memory” (Albergaria-Almeida, 2010, p.306) <sup>[1]</sup>, and that “Teachers ask questions that required students to recall information ...” (Gort, *et al.*, 2012) <sup>[8]</sup>. No matter the difficulty encountered in the classroom situation, teachers must be aware that development of good questioning skill is a quality exhibited by good teachers. In this regard, teachers must aspire to such good qualities in teaching and learning environment.

Findings based on intra-observer evaluation of data showed that a total of 36 questions were asked by the teacher in a 35 minute classroom interaction. Notably, the rate per minute of questions asked by the teacher at various question levels was 0.38 for knowledge, 0.35 for understanding, 0.2 for synthesis, 0.25 for evaluation, and zero for application and analysis questions. Generally, questions posed by the teacher occurred at the rate of one question per minute in the 35 minutes lesson period. One question per minute can be considered a good rate at which questions should occur during lesson delivery.

In our study, we observed with deep concern that the teacher was the only person asking questions without creating opportunity for students to question him. This presented the lesson as a one way affair, where the teacher largely dominated every phase of lesson delivery. Teachers must at all times reduce teaching ineffectiveness and put strategies in place to give equal attention to every aspect of questioning behaviour in teaching and learning environment. Studies in relation to the relevance of students’ questions suggest that “Student-generated questions are an important element in the teaching and learning process, and play a significant role in motivating meaningful learning (Albergaria-Almeida, 2010) <sup>[1]</sup>. Placing emphasis on the relevance of students’ questions, it is again documented that “... valuing students’ questions rather than emphasizing their responses is imperative in supporting learners’ higher levels of thinking” (Almeida, 2012, P.634) <sup>[2]</sup>. In present study, the teacher asked all the questions during lesson period even though the interaction

was between him (teacher) and 38 students.

On the relevance of questioning, it is reported that questioning is an important classroom activity (Shanmugavelu, 2020) <sup>[16]</sup>, and that “Almost every teaching method requires the use of questioning” (Alorvi, 2014) <sup>[3]</sup>. Since teaching generally involves complex tasks, it is important for teachers to plan for the kind of questions they would want students to answer during lesson delivery. Questioning should be seen as one of the relevant tools that teachers can frequently use to facilitate student learning. For quiet students and in situations where the lesson seems boring, questions can be used to trigger communication between the teacher and the students.

To stimulate a high level of thinking, research in the area of questioning suggests that “Teachers must play a key role in applying the right techniques and skills to question students” (Shanmugavelu, 2020) <sup>[17]</sup>. In light of this, it is essential for teachers to adopt effective questioning strategy as a way to keep students actively engaged in the teaching and learning process. It is also essential to note that the quality of questions asked during teaching and learning is as important as the teaching process itself. Generally, higher-level thinking skills are better used in solving problems than lower-level thinking skills. As a result of this, teachers must see effective questioning as part of pedagogical knowledge of professional practice.

From our study and several other studies, most questions posed by teachers occupy lower-level of thinking. This situation does not promote critical thinking among students. In the current study, there was total absence of application questions. Students did not get the opportunity to apply subject matter knowledge in solving problems that related to the lesson. However, evaluation questions, which occupy the highest level of educational objectives (Bloom *et al.*, 1956) <sup>[6]</sup> did not record zero. Zero was however, recorded for synthesis – the second highest level of questions. It is ideal to encourage higher level of questions during teaching and learning process. Attention should be given to all question levels to achieve a balance in the way questions are administered during lesson delivery. Even though students did not ask questions during the lesson, findings revealed that students were offered opportunity to respond to many questions posed by the teacher. Generally, the rate at which questions occurred was one question per minute and this could be described as a good rate at which questions should

normally occur in the teaching and learning environment. Findings from the result indicated that the teacher asked questions at the level of knowledge, understanding, synthesis, and evaluation. More than half of the total number of questions concentrated at the lower-levels (knowledge and understanding). This situation reveals over concentration of low-level questions (knowledge - recall of specific information). To avoid over concentration on questions that do not promote critical thinking among students, teachers need to plan for the kind of questions they would ask students during teaching and learning situation. This can avert total absence of certain desirable question levels during classroom interaction. In the opinion of Lewis (2007)<sup>[10]</sup>, "The ability to ask and answer questions is central to learning" and that "... we as teachers need to plan our questions carefully" (P.1). In this regard, teachers must seek to improve lesson effectiveness as a means to improve student outcome (Goe, 2007)<sup>[7]</sup>. We as teachers must also picture the vitality of the teacher and students as a community of learners committed to questioning, thinking and understanding (Walsh & Sattes, 2015)<sup>[20]</sup>.

Teachers should remember that learners in any teaching and learning situation can be guided to pose questions of their choice for other students to answer. By so doing, active participation of learners in the lesson could increase, making the lesson more enjoyable and lively. Marks could be awarded for learners' contribution and questions asked as part of assessment component to increase the rate of questioning among students. The teacher can decide when he or she would allow students to ask questions on what has been taught. It is necessary for teachers to provide an educational environment that allows students to satisfy their curiosity to ask questions during lesson delivery.

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