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Using soil profile model as an aid to enhance the understanding of the concept of soil profile among basic four (4) pupils' of Fodome – Hloma E.P. primary

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Abstract
The soil profile is where the secrets of the soil and landscape around it are hidden. The soil profile is defined as a vertical section of the soil that is exposed by a soil pit. A soil pit is also explained as a hole that is dug from the surface of the soil to the underlying bedrock.
The paper was to help address poor understanding of soil profile using a model soil profile to enhance the understanding of the concept among basic four pupils at Fodome – Hloma in the Hohoe Municipality. In all, 10 out of 18 pupils were selected for the purpose of the study. Descriptive statistics such as means and simple percentages distribution were used to analyze the data collected. The study showed that, poor teaching method and lack of teaching learning materials contribute to the poor performance of pupils in integrated science lesson. The result revealed that the pre-test mean performance was 2.0 while the post-test mean performance was 9.2. The mean sores therefore established that there are differences between the use of teaching and learning resources in the classrooms and when they are not use in teaching particularly at the basic schools. It is recommended that integrated science teachers should make the teaching of science practical by using teaching and learning materials effectively and by adopting child-centered approach to teaching and learning.

Keywords: soil profile, pupils, modeling, farming, TLR's, effective lessons, concept

Introduction
Farming and agriculture is essential to the success of society as a whole. Without farming everyone would be forced to hunt and gather food and it is not possible for the world population to survive off such eating style. Agriculture started when man found that the food around his dwelling place had become exhausted and he had to travel long distances to obtain his needs. Industrial farming techniques and genetically modified crops allow farmers to produce a much greater amount of food by making use of the soil (Addo-Quaye *et al.,* 1993) [1].

A soil is simply a porous medium consisting of minerals, water, air, organic matter, and microorganisms. The traditionally, Soil is a dynamic natural body having properties derived from the combined effects of climate and biotic activities, as modified by topography, acting on parent materials over time (Encyclopedia Britannica, 2018) [5]. According to Amoah (2011) [3], soil is the accumulation of loose weathered material that covers much of the land surface of the earth. Soil varies in depth, composition, age, colour and texture. Hackett and Moyer, (2001) [7] classified soil into three classes namely; sandy soil, clayey soil and loamy soil.

Soil profile is vertical cross-section through the soil from the top to the bedrock, which shows the various horizons of which the soil is composed. A soil horizon is a layer generally parallel to the soil crust, whose physical characteristics differ from the layers above and beneath. The four component of soil profile include the horizon A (top soil or region of eluviation), the horizon B (subsoil or region of illuviation), the horizon C (weathered material or parent materials) and the horizon D (bed rock) (Amoah, 2011) [3].

Soil profile is one of the interesting topics in the integrated science syllabus designed for Ghanaian pupils in basic schools. Just as any visual teaching aid, a model soil profile is an aid to learning rather than an aid to teaching because it makes the concept of soil profile clearer and easier to understand.

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It is a visual aid that appeals more to the sight and makes visual impression on the learning during a lesson. Indeed, teaching aids give learners the ability to transfer what they have learnt for use in everyday life. The use of teaching learning materials helps learners to understand concepts thoroughly and these help them to further transfer the knowledge for use in life (Kay 2011) [8]. According to Kay, (2011) [8] the sense of sight is the most important part of sense. We receive 60-70% of our information about the world around us through this sense. It is very difficult to teach a good lesson without an aid of some kind. Ohene and Awuku (2002) [10] asserted that models are small but exact copies of real things. As learning aids, they are better than pictures because the pupils can handle them. Models are almost as good as the real thing. Kay (2011) [8] observed that using teaching and learning materials in the course of teaching contributes largely to retention of concepts and ideas which further leads to greater learning. It requires that teaching and learning should be based on hands on experiment and activities. Learning materials are important because they can significantly increase pupils' achievement by supporting pupils learning. For example, a model may provide a pupil with important opportunities to practice a new skill gained in class (Ministry of Education, Guyana, 2018) [9].

The optimum economic growth of developing countries including Ghana depends largely on effective training of people in agriculture and application of scientific knowledge to combat problems of mankind. Therefore, there is the need for pupils in our schools to have adequate knowledge in soil profile since it determines the type of crops to grow, when to grow them and the type of tools and equipment to use for tillage.

Interestingly enough, the study area is a farming community and therefore, the inhabitants are farmers. According to Food and Agriculture Organization, FAO (2010) [6], over 1 billion people are employed in world agriculture. Also, in Sub-Saharan Africa, over 60% of the entire workforce are involved in agriculture. Agriculture employs over 64% of the total workforce in Ghana (The Global Economy, 2017) [11].

We deemed it necessary as trainers of teachers to help address classroom problem once it is noticed so that together we can bridge the gap in teaching and learning among pupils in the basic schools. In view of this idea we quickly serve as mediators to assist the lesson in soil profile after observing and supervising a bad delivery of the topic. This we know will build the knowledge of the mentor, mentee and the pupils.

Purpose of the Study
Considering the problem stated in the introduction, this paper will enable us to design a model soil profile to assist basic four pupils of Fodome-Hloma to identify and explain the layers of soil profile, explain the characteristics of the various layers of soil profile and state the importance of soil profile.

Research Questions
In order to achieve the objectives of the study, we attempt to address the following questions which serve as a guide to the study:

1. How can the use of a soil profile model enhance pupils understanding of the concept of soil profile?
2. How would the use of the model reveal the causes of poor understanding of soil profile by basic four pupils of Fodome-Hloma E.P Primary School?
3. How would the use of the model highlight the importance of TLRs as effective way of teaching?

Significance of the Study
The study would contain research findings which can contribute to existing knowledge and can serves as a reference material for the teachers and pupils in the school and elsewhere in the world. The study would prepare the mentor and mentees for good research practices towards further studies. It would also serve as a learning tool for the mentors because, it was also evident that most mentor within the school are not updating their knowledge enough to mentor the new student teachers that are posted to their schools to understudy them. Besides, the findings of the study can challenge science teachers to be more resourceful in using readily available materials in the school environment to improvise teaching and learning materials.

Methodology
Setting of the study
The study took place in Fodome-Hloma E.P Primary School. Fodome-Hloma is a community located in the Hohoe Municipality in Volta Region of Ghana. It has a population of about 600 people. The inhabitants are predominantly Ewes. Our visit to the school during teaching practice supervision and lesson observation helped us met and interacted with pupils and some teachers so that we could assist to solve certain pressing issues and problems facing pupils leaning in the school community. Our observation indicated that, majority (90%) of the pupils in basic four were unable to explain the concept of soil profile.

Research Design
The study adopted an action research design to help curb the identified problem in the classroom among basic four pupils' of Fodome – Hloma E.P. primary. According to Amedahe and Gyemah (2008) [2], action research is basically concerned with immediate solution to local problems. It is a type of applied research. The purpose of action research in teaching is to solve classroom problems or a local school problem through the application of scientific methods. According to Donato (2003) [4], action research is a systematic enquiry conducted by researchers to gather information about the ways particular a school operates, how the teachers teach and how well their students learn. The design would also help us to evaluate the effectiveness of our teaching (intervention) and learning process.

Population and Sampling procedure
The pupils of Fodome-Hloma E.P Primary and teachers of the school were the targeted population for this study. The total population of pupils in the school was about 120. The teachers were six consisting of five males and one female. A sample size of 10 pupils were selected out of 18 in basic four for the purpose of this work. The pupils were selected purposively because of the severity of their case. The six teachers were also involved in the study. The teachers were

included in order to get first - hand information on the topic and to provide suitable solution to problem.

Instrument for data collection
The instruments used were interview and test. We used these research instruments to enable us obtain relevant information for the study. The six teachers on the staff were interviewed on their perception about the use of Teaching Learning Resources (TLR's) while the 10 selected people were taken through pre and posttest. In order to ascertain the extent to which the pupils understood the lesson, a pre-test was conducted. It was six questions which was marked out of 10. After the pretest, intervention plan was carried out to help the pupils understand the soil profile concept and also to help visualize the lesson as stated in literature that most learners learn better by seeing. A post-test was also conducted later to evaluate pupils' understanding of the concept of soil profile.

Intervention
Here, we planned a lesson with appropriate teaching learning material (model soil profile). The lesson was on the topic soil profile. In order to make pupils participate fully in the lesson, the guided discovery approach was adopted.

Activity 1: Think and share**:** Let pupils think and share their prior understanding of soil relevant to soil profile with other pupils through questions and by engaging in observation of soil samples to enable each of the pupil explore and explain their ideas about soil. Thereafter, let the pupils pair with a partner and discuss their answers and ideas. Let the pupils share their ideas with the class.
1. What is soil?
   Expected answer: Soil is a thin layer of the earth surface which serve as medium for plant growth and development.
2. Partially decomposed rock material is called what?
   Expected answer: Mineral matter
3. Partially decomposed plant and animal material is called what?
   Expected answer: Organic matter
4. Name the components of soil.
   Expected answers: water, air, organic matter, mineral salt and micro-organism
5. Let the pupils observe sample of sandy soil, clayey soil and loamy soil and describe their physical properties

Activity 2: Lead the pupils to a dug pit on the school compound. Let the pupils observe the pit critically and record their observation on their worksheet for discussion.

Activity 3: Now, the pupils were sent back to the class and introduced to them the concept of soil profile. Let them observed samples of model soil profile prepared by the teacher and let the pupils compare the layers (horizons) of the models to what was observed outside the class (the dug - out pit).

Activity 4: Think-Pair- share: In pairs, let pupils brainstorm to bring out the meaning of soil profile. In pairs, let the pupils observe the model soil profile and let each pair share their observation with the class

Activity 4. Let the pupils work in three groups to identify the various layers of the soil profile and discuss the characteristics of each layer. Let each group share their answers and ideas with the class

Activity 5: In two groups of five, guide the pupils to discuss the importance of soil profile to farmers and share their responses with the whole class.

Activity 6: The pupils were asked to draw the model soil profile into their worksheet and label all the various layers accordingly as shown in figure 1.

Closure: To close this lesson, the pupils were asked a few questions as a review. Those questions are:
1. **What is soil profile?**
Answer: Soil profile is vertical cross-section through the soil from the top to the bedrock, which shows the various horizons of which the soil is composed.
2. **At what depth is a soil profile studied?**
Expected answer: 3-5feet
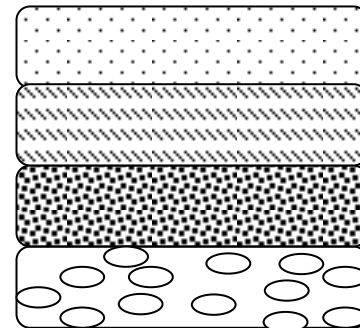3. **What is the 'A' horizon also called?**
Expected answer: Top soil
4. **Give one characteristics of top soil.**
Expected answer: Top soil contain organic matter.
5. **How is the study of soil profile to the farmer?**
Expected answer: It helps the farmer to determine the fertility status of the soil for cultivation of crops.

Assessment: The pupils were assessed informally throughout the lesson with verbal questions and answers. At the end of this lesson, each pupil was given a quiz to check for the understanding of the concept of soil profile.

The model soil profile was then left in the class for two weeks for further studies by the pupils.

Fig 1: Model soil profile

Data analysis
Data collected for the study were analyzed using descriptive statistics such as means, percentages and presented in tables.

Pre-intervention

Table 1: Pre-test results of pupils

Marks (x)	No. of pupils (f)	fx	Percentages (%)
0	3	0	30
1	2	2	20
2	2	4	20
3	1	3	10
4	1	4	10
5	0	0	0
6	0	0	0
7	1	7	10
8	0	0	0
9	0	0	0
10	0	0	0
Total	$\Sigma f = 10$	$\Sigma fx = 20$	100

The pre-intervention mean mark

$$\bar{X} = \frac{\Sigma fx}{\Sigma f} = \frac{20}{10} = 2.0$$

The mean mark (x) = 2.0

From the table 1, 10 pupils took the pre-test which was marked out of 10. The result revealed that 30% the pupils scored zero, 20% scored 1 mark, 20% scored 2 marks, 10% scored 4 marks while 10% also scored 7 marks. Critical observation of the scores showed that majority (90%) of the pupils scored below 5 marks and only 10% also scored 7 marks. The mean score of the pupils was 2.0 indicating how poorly the pupils performed. The poor performance of the pupils was attributed to lack of use of teaching and learning

Result, findings and Discussions
This section shows the analysis and discussion of the interview, pre-test and post-test scores obtain by the pupils. It also shows how the data was represented.

materials by the teachers in the school. Teaching and learning materials refers to a spectrum of educational materials that teachers use in the classroom to support specific leaning objectives, as set out in lesson plans. So, if a teacher fails to use these teaching aids in the course of teaching he or she cannot impact knowledge meaningfully among pupils. At the end, pupils' performance would be abysmal. A typical example is what had been demonstrated in Fodome-Hloma Basic four (Table 1). Kay (2011) [8] explained that sense of sight is man's most important sense. We receive 60-70% of our information about the world around us through this sense. It is very difficult to teach a good lesson without an aid of some kind.

Post-intervention

Table 2: Posttest results of pupils

Marks (out of 10) (x)	Number of pupils (f)	fx	Percentages (%)
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	3	24	30
9	2	18	20
10	5	50	50
Total	$\Sigma f = 10$	$\Sigma fx = 92$	100

The post-intervention test mean mark

$$\bar{X} = \frac{\Sigma fx}{\Sigma f} = \frac{92}{10} = 9.2$$

The mean mark (x) = 9.2

From the table 2, the study revealed that 30% of the pupils scored 8 marks, 20% of the pupils scored 9 marks while majority of 50% scored 10 marks. The mean score of the pupils in the post-test was 9.2. This is an indication that the pupils' performance improved tremendously after suitable intervention was employed where teaching aids were used.

The role of instructional materials in the teaching and learning process cannot be overemphasized. They facilitate and encourage self-study or independent study in pupils. The teaching and learning materials help the teacher to teach more effectively. The use of the model soil profile as teaching and learning material aroused and sustained the interest of pupils throughout the lesson and contributed largely to the pupils' active participation in the teaching and learning process. Also, the model soil profile helped the pupils to learn through firsthand experience. As a result, their performances at the evaluation was excellent where the mean performance was as high as 9.2 compared to 2.0 in the pre-test. This means that there was a great difference of 6.2

between the post-test and pre-test. Indeed, it could be said that teaching and learning materials can increase the internal motivation for learning and help sustain it. Teaching aids also provide a link between what is real and what is abstract so that concepts are more easily understood. Learning materials are important because they can significantly increase student achievement by supporting pupil learning.

For example, a model may provide a pupil with important opportunities to practice a new skill gained in class. This process aids in the learning process by allowing the pupils to explore the knowledge independently as well as providing repetition. Learning materials, regardless of what kind, all have some function in pupils learning (Ministry of Education, Guyana, 2018) [8].

Teacher's perception about the effects of teaching and learning materials on pupils

Table 3: Teachers perception about the effects of teaching and learning materials on pupils

Responses	Number of teachers	Percentages (%)
TLs make the lesson practical	2	33.3
TLMs build the understanding of pupils	2	33.3
TLMs ease teaching and learning in class	1	16.7
TLMs make the real	1	16.7
Total	6	100

From the table 3, the result of the study showed that 33.3% of teachers perceived that teaching and learning materials make lesson practical. According to Ohene and Awuku (2002) [10], models are small but exact copies of real things. As learning aids, they are better than pictures because pupils can handle them. Models are almost as good as the real things. Again, 33.3% of teachers were also of the view that teaching and learning materials build the understanding of pupils. Indeed, the use of teaching and learning materials could contribute to initial and retention of concepts and ideas which further promote greater learning which is permanent. Also, 16.7% of teachers stated that teaching and learning materials ease teaching and learning in class while another 16.7% of teachers also stated that teaching and learning materials make the lesson real. This could be attributed to activity method of teaching scientific concepts where pupils are made to interact with materials to discover concepts and facts and enable them to exploit their environment in order to acquire knowledge and get deeper understanding of the environment through discovery of concepts, facts and ideas etc.

Conclusions and Recommendations
The study revealed that pupils had difficulty in understanding the concept of soil profile, teachers also did not use appropriate teaching and learning materials in teaching practical related lessons and pupils performed better after the intervention. That is, the post-test mean score of 9.2 was much higher than the pre-test mean score of 2.0. This indicated that the intervention employed by the facilitators was successful and therefore yielded the desired outcome. The data also brought to light the importance of teaching and learning materials in effective teaching and learning in classroom is stressed in the Chinese proverb; I hear and I forget, I see and I remember, I do and I understand. Based on the findings it was concluded that

- Pupils' performed poorly when tested on the concept of soil profile due lack of the use of appropriate and effective teaching and learning materials.
- The improved performance was due to the suitable intervention, (that is the use of practical model of soil profile).
- Pupils would understand lessons better and also perform better on test when suitable teaching and learning materials and appropriate teaching methods are used in teaching.

On the basis of the findings the following recommendations were made
- Firstly, the Head teachers should ensure that teachers improvise teaching and learning materials and use them in the school for practical lessons especially in science.
- Secondly, the Ghana education service should also ensure that enough teaching and learning materials are provided for schools for practical teaching and also give enough time in the curriculum for focus teaching and learning.
- Thirdly, no topic (s) should be least regarded or overlooked as it may also impede pupils' progress in subsequence lessons related to the topic or subject understudy.

Limitation
Our efforts were limited by certain constraints while carrying out this study. We need to travel *to* and *fro* before getting access to the study area and the pupils which caused a lot of inconveniences to us. Also, the pupils' absence from school anytime we tried to conduct a test for specific outcome. In addition, time was also inadequate for the study, since we were attending workshops, doing teaching and other equally important assignments as well as undertaking the study within the short time frame because we need to finish before our students end the 2017/2018 academic year in order to complete their internship programme.

Suggestion for Further Studies
Since our study was based on pure descriptive, thus the use of mean and frequency distribution due to time constrain we therefore suggest that future study on this topic should be done using inferential statistical analyses so that the results can be compared

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