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An investigation into first year elective science and integrated science students' understanding of length in measurement of Bueman senior high School (BUSEC), Jasikan

Kumassah Eliot Kosi

Department of Science, Jasikan College of Education, P.O Box 14, Jasikan, Volta Region, Ghana, West Africa.

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ABSTRACT

Conversion within quantities of same units and between quantities of different units is a thorny subject to Elective and Integrated Science students of Bueman Senior High School and its treatment by tutors sometimes becomes very difficult such that most tutors resort to handling the subject theoretically / abstractly. When this happens most students seemed not to comprehend the subject. In view of this, one aspect of the DTM-Conversion model (i.e. D-Conversion model) was tested on first year Elective Science and Integrated Science students of Bueman Senior High School, Jasikan. The DTM-Conversion Model is a model that has been designed by the researcher to make the teaching of conversion in measurement very easy to tutors and meaningful to students. The D-Conversion Model was tested on forty nine (49) 2011/2012 first year Elective science students and forty nine (49) Integrated Science Students' all of Bueman Senior High School by teaching the D-Conversion Model for a period of two hours. A five item test was administered, collected and recorded. Comparison of the two test results i.e. Test before the lesson (TBL), and Test with the use of the D-Conversion model (TDC) showed that, Elective and Integrated Science students seemed to comprehend conversion of length in measurement when the D-Conversion model was employed.

Introduction

Related Literature

Conversions are an integral part of much scientific practice, for example to allow for ease of data processing, to enable comparison and standardization and to support the understanding of physical quantities and processes (Molyneux & Sutherland, 1996). It is therefore crucial for students to become competent in converting between units.

Conversion within quantities of same units and between quantities of different units is a thorny subject to students and its treatment by tutors sometimes becomes very difficult such that tutors resort to handling the subject theoretically/ abstractly. When this happens most students seemed not to comprehend the subject. One aspect of the DTM-Conversion model (Kumassah, 2012a; Kumassah, 2012b) was used in this study from the premise that learning to convert between units of measurement is critical to a learners' development in the realm of science and other courses and that having access to a general method would support students' efficiency in converting (Butterfield, Sutherland & Molyneux-Hodgson, 2000). The focus for using one aspect of the DTM-Conversion model in this study was on the role of a general rule for converting and this arose out of a detailed observational study of first year Integrated Science Students' of Bueman Senior High School working through their integrated science course on measurement (Molyneux & Sutherland, 1996).

Research Question

What is first year Integrated Science Students' and Elective Science Students' of Bueman Senior High School understanding of Conversion of Length in Measurement?

Statement of the Problem

It has been reported that Conversion within quantities of same units and between quantities of different units is a thorny subject to students (Butterfield, Sutherland & Molyneux-Hodgson, 2000; Kumassah, 2012b) and its treatment by tutors sometimes becomes very difficult such that most tutors resort to handling the subject theoretically / abstractly ((Butterfield, Sutherland & Molyneux- Hodgson, 2000). When this happens most students seemed not to comprehend the subject (Kumassah, 2012b). The same problem can also be said of first year students of Bueman Senior High School when the researcher visited the school in January, 2012. The first year students of Bueman Senior High school study two major subjects' i.e. Elective Science and the Rest Subjects. Elective Science students in this research are presumed to have much knowledge and understanding of science from their Junior High Schools, while the Rest Subject students are presumed not to have much knowledge and understanding of science from their Junior High Schools.

If this presumption is true, then how come that even Elective Science students of this school faced the same problem as their counterparts studying the Rest Subjects? In view of this, could this problem of first students' inability to comprehend conversion of length in measurement be due to the teaching methods of subject tutors, students' anxiety, and the theoretical handling of the subject by tutors? As one may not really be certain of the cause of the problem, it is imperative to conduct a research in order to see whether first year elective science students understand conversion of length in measurement better

Tele: (+233)279668041

E-mail addresses: ekumassah@yahoo.com

to integrated science students or vice versa and also to see whether the use of one aspect of the DTM-Conversion model i.e. D-Conversion model on the students could help minimise this problem in students of Bueman Senior High School.

Population

480 students i.e. 180 Elective science students and 300 Integrated Science students

Sample Size

98 students i.e. 49 Integrated Science Students and 49 Elective Science Students

Sampling Procedure

Simple random sampling technique was employed in selecting the sample for the study (Ary & Razavieh, 2002). Microsoft Excel was used in selecting the sample.

The Microsoft Excel assigned random numbers to students' names that were imputed into it. Sixteen percent (16%) sample size was selected from 300 integrated science students while (27.2%) sample size was selected from 180 elective science students. This 16% sample size of the integrated science students and 27.2% of elective science students (Ary & Razavieh, 2002) was sufficient for this study.

The differences in the percentages of the sample size was due to the fact that the researcher wanted a uniform / same sample size from each population i.e. integrated science students and elective science students.

Discussions and Results

Research question i.e. what is first year Integrated Science Students' and Elective Science Students' of Bueman Senior High School understanding of Conversion of Length? This research question sought to find out whether Integrated and Elective science students understand conversion of length in measurement.

Before the D-Conversion model was introduced to the students, a five item test on conversion of length was administered to the students (Appendix B). This test served as (1) a diagnostic test on students to see their entry behaviours before the lesson and (2) to test students' level of understanding on conversion of length after the introduction of the D-Conversion model.

The results (Table 1a) showed that only a handful of the elective science students (32.7%) were able to convert in length and thus were a little above the average mark (2.5) while (Table 1b) also showed that a handful of integrated science students (10.2%) were able to convert in length and thus were a little above the average mark.

This meant clearly that the 2011/ 2012 first year elective science and integrated science students' of Bueman Senior High School before the introduction of the D-Conversion model had difficulty in doing calculations on conversion of length. This result agreed with a study conducted earlier by the researcher on an investigation into Jasikan College of education (JASICO) diploma in basic education students' understanding of length in measurement. A more vivid of this result is shown in figure 1a and 1b.

This D-Conversion model exposes students to practical aspect of conversion on length. The D-Conversion model was introduced in order to see whether students will be able to understand conversion of length.

Figure 1: Diagram of diagnostic Test results before the lesson

Figure 1a: diagnostic Test results of Elective Science students before the lesson

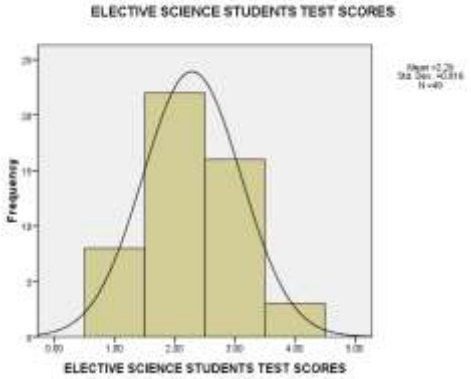
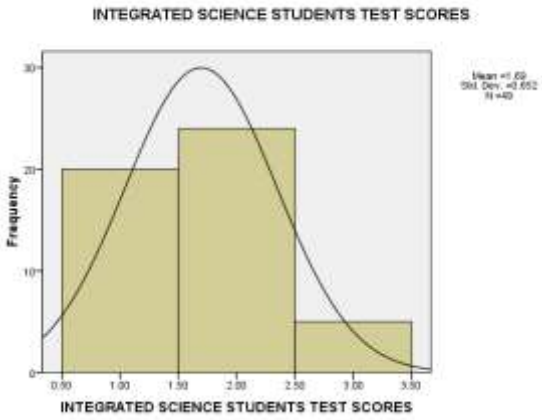


Figure 1b: diagnostic Test results of Integrated Science students before the lesson



The results (Table 2a) showed that most of the elective science students (14.3%) were able to convert in length and thus were within the three (3) marks and 46.9% were within the four (4) mark. However 24.5% of elective science students were still below and within the two (2) mark. Even though some students were still below the average mark, yet 14.3% of elective science students hard excellent marks. The word excellent mark as used here meant students whose test scores were within 5th mark (Table 2a).

Also (Table 2b) results showed that 46.9% of integrated science students were above the average mark i.e. they are within the three (3) marks and 28.5% of integrated science students had excellent marks i.e. marks that are within the 4^{th} mark and the 5^{th} mark. These result again agreed with a study conducted earlier by the researcher on an investigation into Jasikan College of education (JASICO) diploma in basic education students' understanding of length in measurement (Kumassah, 2012b). The 46.9% (Table 2a) of Elective science students and the 26.5% (Table 2b) of integrated science students showed that the use of the D-Conversion model to some extent helped improved upon Elective science and Integrated science students understanding of conversion of length in Bueman Senior High School. A more vivid of this result is shown in figure2.

Figure2: Diagram of Test score with the use of D-Conversion model

Figure 2a: D-Conversion model Test score results of Elective Science students before the lesson

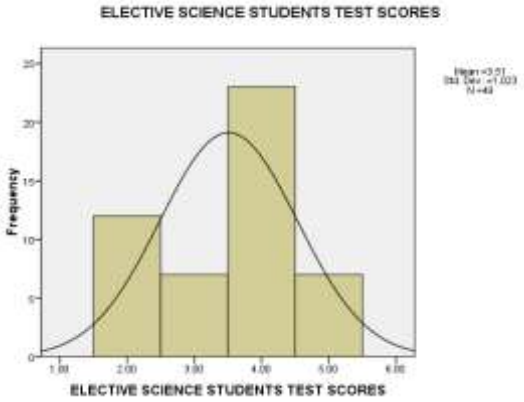
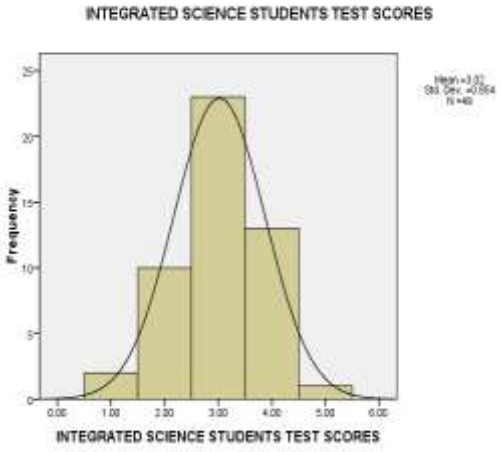


Figure 2b: D-Conversion model Test results of Integrated Science students before the lesson



In conclusion to the research question; this study has revealed that indeed the D-Conversion model has helped the first year Elective science and Integrated science students' of Bueman Senior High School to grasp the concept of conversion of length. However, that goes not mean that the D-Conversion model is the most perfect practical method for teaching conversion of length in measurement. Yet the use of the D-Conversion model revealed in this study that teaching conversions practically in general will enable students to better understand the concept of conversion. The researcher is not conclusively saying that the use of the DTM-Conversion model in teaching conversion should be the only appropriate tool to be used by teachers and educators in teaching conversion. But its use might have a long standing effect on students understanding of conversion at all levels of education in Ghana.

Reference

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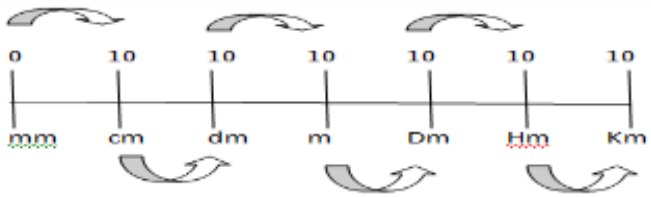
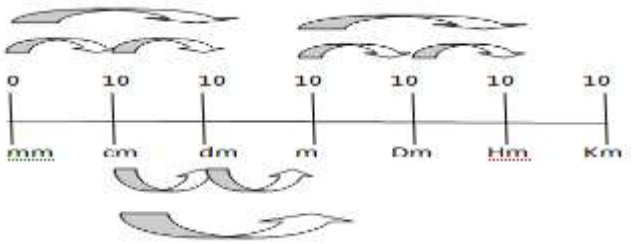
Appendix A

The D-Conversion model (adopted from Kumassah E.K, 2011)

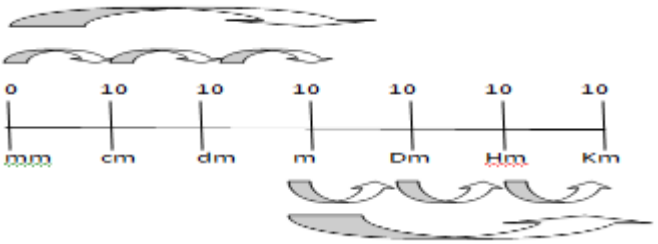
One Step/ Movement



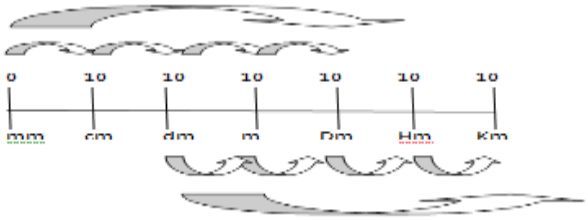
Two Step/ Movement



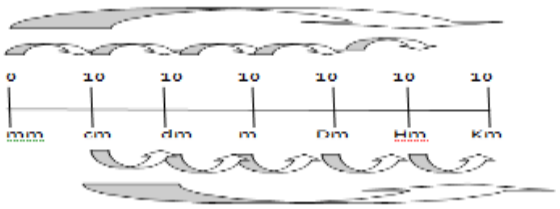
Three Step/ Movement



Four Step/ Movement



Five Step/ Movement



Six Step/ Movement

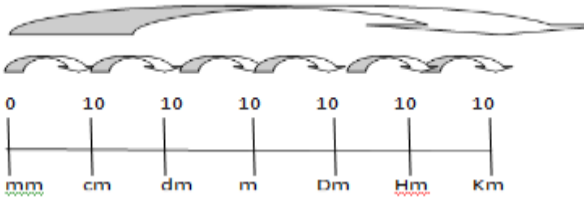


Table 1: Diagnostic Test results before the lesson (N= 49)

Table 1a: Elective Science Students Test Scores

Test Scores	Frequency	%
1	8	16.3
2	22	44.9
3	16	32.7
4	3	6.1
N	49	100.0

Table 1b: Integrated Science Students Test Scores

Test Scores	Frequency	%
1	20	40.8
2	24	49.0
3	5	10.2
N	49	100.0

Table 2: Test scores with the use of D-Conversion model (N= 49)

Table 2a: Test scores with the use of D-Conversion model of Elective Science students

Test Score	Frequency	%
2	12	24.5
3	7	14.3
4	23	46.9
5	7	14.3

Table 2b: Test scores with the use of D-Conversion model of Integrated Science students

Test Scores	Frequency	%
1	2	4.1
2	10	20.4
3	23	46.9
4	13	26.5
5	1	2.0

Appendix B

Test Items	Correct Answer	Scoring Rubric
change 1.5mm to ?cm	0.15cm	1 mark
convert 1.5dm to ?Dm	0.015Dm	1 mark
change 98Hm to ?cm	980000cm	1 mark
convert 98m to ?Km	0.098km	1 mark
change 1.5km to ?mm	1500000mm	1 mark

Appendix C

Test Results of BUSEC 1A Pass mark = 2.5

Diagnostic Test Scores of Elective Science Students	Diagnostic Test Scores of Integrated Science Students	D-Conversion model Test Scores of Elective Science Students	D-Conversion model Test Scores of Integrated Science Students
1.0	2.0	2.0	3.0
1.0	2.0	4.0	3.0
1.0	2.0	4.0	3.0
1.0	2.0	4.0	3.0
2.0	2.0	4.0	3.0
1.0	2.0	3.0	3.0
1.0	2.0	3.0	3.0
1.0	1.0	3.0	3.0
2.0	1.0	2.0	2.0
2.0	1.0	2.0	2.0
4.0	1.0	4.0	5.0
2.0	1.0	2.0	2.0
2.0	1.0	5.0	2.0
2.0	1.0	5.0	2.0
2.0	1.0	5.0	2.0
2.0	1.0	5.0	2.0
3.0	1.0	2.0	2.0
3.0	1.0	4.0	2.0
3.0	1.0	2.0	1.0
3.0	1.0	4.0	1.0
3.0	1.0	4.0	3.0
3.0	1.0	4.0	3.0
3.0	1.0	2.0	3.0
3.0	1.0	2.0	3.0
3.0	1.0	4.0	3.0
2.0	2.0	2.0	3.0
1.0	1.0	3.0	3.0
2.0	3.0	3.0	3.0
2.0	3.0	3.0	3.0
2.0	3.0	3.0	3.0
2.0	3.0	2.0	3.0
2.0	3.0	4.0	3.0
4.0	1.0	4.0	3.0
2.0	2.0	4.0	3.0
2.0	2.0	4.0	3.0
2.0	2.0	4.0	4.0
2.0	2.0	2.0	4.0
2.0	2.0	4.0	2.0
2.0	2.0	4.0	4.0
2.0	2.0	4.0	4.0
2.0	2.0	4.0	4.0
3.0	2.0	4.0	4.0
3.0	2.0	4.0	4.0
3.0	2.0	5.0	4.0
3.0	2.0	5.0	4.0
3.0	2.0	5.0	4.0
3.0	2.0	4.0	4.0
3.0	2.0	4.0	4.0
4.0	2.0	4.0	4.0