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An investigation into the use of D-Conversion model solution-calculator on second year early childhood students' of Jasikan college of education in Jasikan district of Ghana

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ABSTRACT

Jasikan College of Education is a college that has been designated to serve as Teacher Education Institution, which trains teachers academically and professionally to teach at the basic school level in the Ghana. Based on this vision, the college runs two major programs i.e. "The General Education Program" and "The Early Childhood Program". The Early Childhood program is a program that sees to the training of teachers to teach at the lower primary schools in the country such as classes (1-3), and kindergartens (1-2). At these lower primary levels, pupils and teachers are not expected to do arithmetic's with simple and or programmed calculators in any of the subjects. However, when it comes to arithmetic's on conversion of S.I units, most teachers and pupils in class three end-up using calculators in arriving at answers / solutions. When this happens most pupils tend not to comprehend the subject. In view of this the researcher designed "The D-Conversion model Solution Calculator" from the Distance conversion model (The D-Conversion model) to help both teachers and pupils arrive at answers very easy to tutors and meaningful to pupils when it comes to conversion of distance. This D-Conversion model Solution Calculator is a tool which helps one to arrive at the same answers that simple and or complex calculators give. The D-Conversion model Solution Calculator on one dimension distance (length) was tested on the 114 second year Early Childhood students of Jasikan College of Education. Its used in this study was (1) to see whether the 2011/ 2012 Early Childhood students will be able to perform some arithmetic's on conversion of length without the use of calculators and (2) to aid the 2011/2012 Early Childhood students design their own teaching and learning material in teaching conversion to the use of calculators as a teaching and learning material in their out-segment schools and or their posted schools.

Introduction

Related Literature

During the 1970's and 1980's there had been a gradual international move towards the recommended student use of calculators from Kindergarten (Howard, 1992). Calculators allow for students access to mathematical concepts and experiences from which they were previously limited with only paper and pencil. This is because calculators made possible mathematical exploration, experimentation and enhancement of learning mathematical concepts (Pomerantz, 1997). Many studies have indicated that the use of calculators can enhance students' ability to learn basic facts and those students who used calculators frequently exhibited more advanced concept development and problem solving skills than those who did not use calculators (Kaino & Salani, 2004).

However, the 1970's had seen researches focused on the effect of the calculator on students' computational skills (Howard, 1992). This is because a recent newspaper article critical of calculator use reported that calculators harm students' ability to learn mathematics (Stiff, 2001). An example similar to the following was cited: A fifth grader, Tamika, age 10, says she likes to buy potato chips for 60 cents and chocolate chip cookies for $1.15. When asked to find the sum, she enters the numbers in her calculator, but forgets a decimal point. "Sixty-one dollars and 15 cents," she says. The article concludes that this and similar examples demonstrate that calculator use among elementary school students is bad (Stiff, 2001). Also, one may ask "Don't calculators just give students the answer?" Unfortunately, this stance on calculators prompts many teachers, even those in early grades, to opt out of using calculators in the classroom. This is because the goal of instruction is to help students practice computation skills, then this decision to not use a calculator makes sense (Center for Implementing Technology in Education (CITEd), 2007).

It is true that the use of calculators in the classroom by students had enhanced learning mathematical concepts and had brought about problem solving skills in students. Yet, its used in the lower primary such as classes (1-3) the kindergartens (1-2), might nor be helpful to these pupils, since their mind and body has not yet reached that advance stage of mathematical computation where by calculators be use on them. Also when teachers want students to engage in higher-order thinking such as solving problems, exploring patterns, conducting investigations, and working with real-world data, the use of calculators can benefit all students, especially those with learning disabilities who might otherwise be unable to

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participate in these engaging activities (CITEd), 2007).

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. The D-Conversion model solution-calculator (Kumassah, 2012) was adopted and 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 D-Conversion model solution-calculator in this study was on the role of a general rule for converting and this arose out of a detailed observational study of the Early Childhood students' of Jasikan College of Education working through their Mathematics course outline on measurement (Mathematics Syllabus, 2008).

Research Question

What is second year Early Childhood students' understanding of D-Conversion Solution-Calculator on Length of Jasikan College of Education?

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, 2012) 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, 2012). In view of this problem, it is prudent that a study be carried out on second year Early Childhood students of Jasikan College of Education.

The second year Early Childhood students of Jasikan College of Education study various subjects including mathematics. These students in this research are assumed to have much knowledge and understanding of converting without the use of calculators from their first year mathematics lessons and senior high school mathematics lessons.

If this assumption is true, then a study must be carried out to confirm or refute the assumption. To achieve this, the D-Conversion model solution-Calculator (Kumassah, 2012) was employed.

Population

114 second year Early Childhood students in Jasikan College of Education

Sample Size

114 second year Early Childhood students in Jasikan College of Education

Sampling Procedure

Purposive sampling technique was employed in selecting the sample for the study (Ary & Razavieh, 2002). The purposive sampling technique was used because the researcher used all the Early Childhood students in the second year of Jasikan College of Education. All the students were used because the lesson is for all of them in knowing how to design a teaching and learning material such as the D-Conversion Solution-Calculator in teaching conversion in mathematics to pupils at both the lower primaries and the kindergartens', rather than just to a few of them. Due to this, there was no need to leave out any second Early Childhood student of Jasikan College of Education from the study

Discussion and Results

Research question on second year Early Childhood students' understanding of the D-Conversion Solution-Calculator on Length of Jasikan College of Education?, sought to find out whether second year Early Childhood students of Jasikan College of Education understand length by the use of the D-Conversion Solution-Calculator to the actual Calculator.

Before the D-Conversion model Solution-Calculator was introduced to the Early Childhood students, three separate test items were administered to the Early Childhood students i.e. (1) a one item test on conversion of length was administered to the Early Childhood students (Appendix B), then a review of the D-Conversion model was done and after the review of the D-Conversion model, (2) a similar one item test on conversion of length was administered to the Early Childhood students (Appendix C), then before the introduction of the D-Conversion model Solution-Calculator, (3) one item test without the use of calculators D-Conversion model and conversion-factors on conversion of length was administered to the Early Childhood students (Appendix D). These tests served as a diagnostic test on Early Childhood students to see their entry behaviours before the lesson on the D-Conversion model Solution-Calculator.

The results (Table 1a) showed that only a handful of the students (31.6%) were able to convert in length. This shocked the researcher greatly. This is because these very students during their first year's lesson in Integrated Science were taught measurement by the researcher and the D-Conversion model was introduced to them, and then just a year after, most of these students seemed to have forgotten entirely what were taught them in their first year in Integrated Science on measurement. Also, based on this result, the researcher observed that the current second year Early Childhood students because the subject was changed from integrated science to mathematics, students were not able to relate their first concepts of conversion in integrated science to that of mathematics.

Based on this result, the researcher interviewed three Early Childhood students on the test item. The researcher purposively selected three students to be interviewed. This was what transpired between the researcher and the students.

Researcher: "Why, it seemed you are not at home with this question (Ama Kudjo measured the

length of her desk to be 4000cm (centimetres). What is the equivalent of 40cm in Dm (decametres))?"

Student 1**:** "But sir, ah! This mathematics is too difficulty for me"

Student 2: "Sir because of this type of calculation that is why I chose Early Childhood program"

Student 3: "Sir I cannot do this. But Sir, this topic is not part of our mathematic course outline this semester, so I did not prepare for it and as such too, am not good in mathematics"

Researcher: "Tell me, did I teach you conversion in measurement using some models when you were in first?"

Student 1: "But sir, ah! That was Integrated Science and as such we did learn conversion in measurement during the first

semester of first year. First year first semester to second year second semester is over a year now and I have forgotten most of the things we learnt in conversion"

Student 2: "Sir, so this was a conversion question? The word equivalent in the question

confused me so much so that, I was not able to discern that it was a conversion question"

Student 3: "Sir but, that was in Integrated Science and this is Mathematics"

From these students response, it could be seen clearly that, they were not able to relate conversion in Integrated Science to that of the Mathematics. They thought that conversion in science is a separate entity from that of mathematics. Also they seemed to forget most the things learnt in their year one at the college. Students' inability to relate one subject to the other at this level of education is a big issue of concern. This is because, if they cannot relate at this stage, then how are they going to teach effectively to their younger ones at the lower primaries' and the kindergartens for their lessons to become meaningful to the pupils at the lower primaries' and the kindergartens? This in my view I think, Professor Joseph Ampiah Gartey, Dean Faculty of Education, University of Cape Coast and a Chief Examiner for Integrated Science for Colleges of Education in Ghana, during one of its marking centres in 2007 at Salpond, Central Region, Ghana stress the need for teachers when teaching measurement, "please teach and emphasis the conversion aspect too to the students"

Table 1a: Students Diagnostic Test Scores before review of the D-Conversion model (N= 114)

Test Scores	Frequency	Percent
wrong	78	68.4
correct	36	31.6

In view of students' response in Table 1a, the researcher reviewed the D-Conversion model with the students. After which a similar test item on length was administered again to the students.

The results (Table 1b) showed that (64%) of students were able to convert in length. Well, the researcher can not conclude whether it was the review of the D-Conversion model that had improved these students performance on the second test item to the first item test, and or during the first test item, most of the students decided to solve the first test item any how.

Table 1b: Students Diagnostic Test Scores after review of the D-Conversion model (N= 114)

Test Scores	Frequency	Percent
wrong	41	36.00
correct	73	64.00

In view of students' response in Table 1b, the researcher administered another test item but of a little difficulty to the students. Instead of the students using the D-Conversion model, calculator and or conversion-factor in converting with length, the students were rather asked to convert with length without using a calculator, the D-Conversion model and conversion-factor to arrive at the same answer that a calculator would give. That is, they must use their brain to arrived at the answer and they should be able to describe vividly to the class how they arrived at the answer.

The results (Table 1c) showed that only a handful of the students (4.39%) were able to convert in length. This result as it stands means that, as at this age of these students, they have difficulty in using their brain i.e. "mental" in converting lengths, but rather are used to calculating things with calculators. Thus without the use of calculators, these students would not be able to convert with length, which is very serious as these students would be going out there to teach their siblings at the lower primaries and the kindergartens. The result of this study agrees with Stiff, (2001) and CITEd, (2007) that calculators harm students' ability to learn mathematics.

Table 1c: Students Test Scores before the D-Conversion model Solution-Calculator (N= 114)

Test Scores	Frequency	Percent
wrong	109	95.61
correct	5	4.39

In view of students' response in Table 1c, the researcher then introduced the D-Conversion model Solution-Calculator to the students, after which a similar test (Appendix F) to that of test three in table 1c was administered to the students to see whether they would be will be able to understand the use of the D-Conversion model Solution-Calculator in arriving at the same answer that the actual calculator gives.

The D-Conversion model Solution-Calculator (Appendix E), is a solution-calculator designed from the D-Conversion model by the researcher to expose students to practical aspect of conversion of length without the use of calculators i.e. "I see, know, I understand and I will never forget". Thus, with the use of the D-Conversion model Solution-Calculator makes students to see how calculations on conversion of lengths are done and how the answers are arrived at, the same as that of the calculator.

The results (Table 1d) showed that (75.4%) of students were able to convert in length. This result as it stands means that students were able to convert in length without the use of calculators and they were able to arrive at the answer, same as that of the calculator.

Table 1d: Students Test Scores after the D-Conversion model Solution-Calculator (N= 114)

Test Scores	Frequency	Percent
wrong	28	24.60
correct	86	75.40

The researcher interviewed one student who finished first on the test item but used the D-Conversion model Solution-Calculator very well to arrive at the answer.

Researcher: "how did you feel when you got the answer?"

Student: "Sir, am very happy, because some way somehow I now know and understand the operations of a calculator. The D-Conversion model Solution-Calculator is very easy and interesting tool to work with. One can even use this in teaching games, seriously Sir; it is just like a game"

Well, this was what the student said that it was more like a game. Maybe it is, maybe not because that was not the mind set of the researcher in designing it. The researcher idea was that, students and pupils will be able to do simple calculation and conversion on their own without having to resort to calculators and mathematical formulas. With this, the researcher is of the view of teacher trainees (student teachers') will be able to design this Calculator in during in their out segment to teach conversion to the pupils.

Conclusion

In conclusion to the research question, this study has revealed that the use of the D-Conversion model Solution-Calculator has helped the second year Early Childhood students of Jasikan College of Education to be able to convert in length without the use of a calculator. The classroom implication is that, the use of the D-Conversion model Solution-Calculator

enables the practical calculation of conversion in measurement. And when this is done, pupils are in the position to better understand calculation of conversion in measurement.

Recommendation

It is recommended that mathematics teachers at the basic school level in the district, the region and the country at large should emphasis more on calculation of lengths without the use of a calculator any time they are to teach the subject, since the results of this study revealed that Early Childhood students of Jasikan College of Education have difficulties in this area.

Suggestion for Future Study

It is suggested that similar study be carried out in mathematics related subjects at the Universities, Polytechnics, Colleges of Education and the Basic Schools, since measurement is a requirement at these levels. This is because students at these levels may be facing such difficulties as their colleagues at Jasikan College of Education

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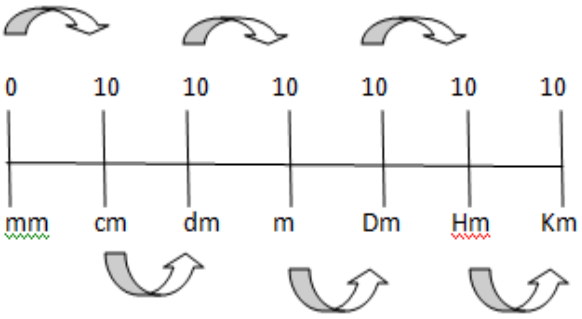
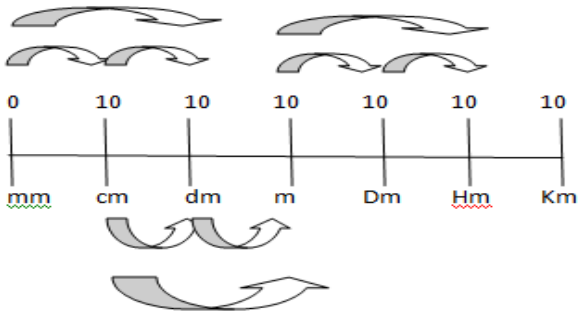
Appendix A

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

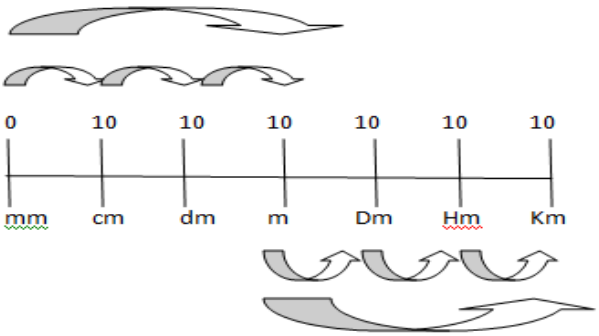
One Step/ Movement



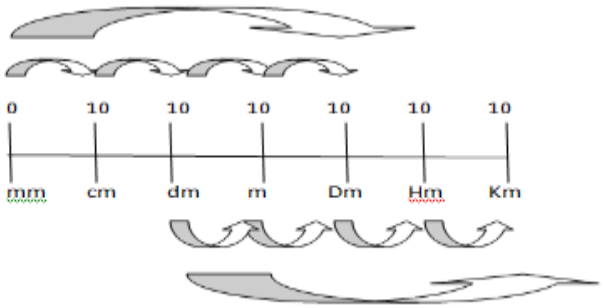
Two Step/ Movement



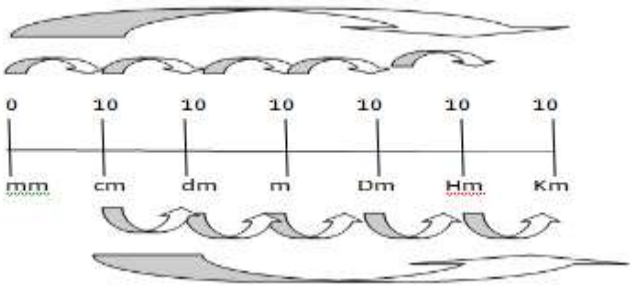
Three Step/ Movement



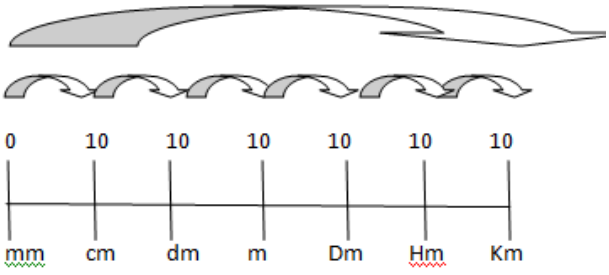
Four Step/ Movement



Five Step/ Movement



Six Step/ Movement



Appendix B
Test Question before review of the use of the D-Conversion Model

Test Item	Correct Answer	Scoring Rubric
Ama Kudjo measured the length of her desk to be 4000cm (centimetres). what is the equivalent of 40cm in Dm (decametres)	4.0Dm	1 mark

Conversion factor i.e. between mm to cm, dm, m, Dm, Hm, and Km

$10(1\times10^{1})$ mm = 1cm
$100(1\times10^{2})$ mm =1dm
$1000(1\times10^{3})$ mm = 1m
$10000(1\times10^{4})$ mm = 1Dm
$100000(1\times10^{5})$ mm = 1Hm
$1000000(1\times10^{6})$ mm = 1Km

Appendix C
Test Question after review of the use of the D-Conversion Model

Test Items	Correct Answer	Scoring Rubric
1. convert 5.0mm (millimetres) to ?dm (decimetres)	0.05dm	1 mark

Appendix D
Test Question without the use of Calculators, the D-Conversion Model, and a Conversion-factor.

Test Items	Correct Answer	Scoring Rubric
Instruction: Without the use of calculators, the D-Conversion model and a Conversion-Factor		
1. change 98Hm to ?cm	980000cm	1 mark

Appendix E
The D-Conversion model Solution-Calculator (Adopted from Kumassah E.K & YOKOO M, 2012)

The D-Conversion model Solution-Calculator is a calculator in a form of a box i.e.

Because the units are from millimetre to kilometre, seven boxes are drawn to make up the complete D-Conversion model Solution-Calculator i.e.

Each box is labelled mm up to km i.e

Km		Hm		Dm		m
dm		cm		mm		

The following are the four steps instructions on the use of D-Conversion model Solution-Calculator

1.Mark the boxes of START (the unit do mention) and GOAL (the unit become an answer).

2. Write the number of ONES in the START, after that write remaining numbers in next box. NB: make sure not to change the order of numbers. (Left box is Tens, two boxes down is Hundreds, right box is decimal places)

3. Put "0" in the empty boxes between START and GOAL.
4. Put the decimal point (.) in the GOAL.

Example 1

To convert 65 mm to? Dm

Method / Solution

Km		Hm		Dm		m
dm		cm	mm			

Start is "mm", goal is "Dm"

65mm, 5 is one's, and 6 is ten's; place 5 one's in the mm box, 6 in the cm box

Ones

						5
Km		Hm		Dm		m
dm		cm	mm			

Next, place, 6 in the cm box

Ten's *Ones*

					6	5
Km		Hm		Dm		m
dm		cm	mm			

Next, from 6 to the Dm, place 0's in the boxes

Ones

		0	0	0	6	5
Km		Hm		Dm		m
dm		cm	mm			

Last, put the decimal point (.) in the Dm box

Ones

		0.	0	0	6	5
Km		Hm		Dm		m
dm		cm	mm			

The answer is 0.0065 Dm

Appendix F
Test Question with the use of the D-Conversion model Solution-Calculator

Test Items	Correct Answer	Scoring Rubric
Instruction: Using the D-Conversion model Solution-Calculator convert 98m to ?Km	0.098km	1 mark

Method / Solution

Km		Hm		Dm		m
dm		cm	mm			

Start is "m", goal is "Km"

98m, 8 is one's, and 9 is ten's; place 8 one's in the m box, 9 in the Dm box One's

			8			
Km		Hm		Dm		m
dm		cm	mm			

Next, place, 9 in the Dm box

Ten's *Ones*

		9	8			
Km		Hm		Dm		m
dm		cm	mm			

Next, from 9 to the Km, place 0's in the boxes

Ten's *Ones*

0	0	9	8			
Km		Hm		Dm		m
dm		cm	mm			

Last, put the decimal point (.) in the Km box

Ten's *Ones*

0.	0	9	8			
Km		Hm		Dm		m
dm		cm	mm			

The answer is 0.098 Km