Teaching Science through the Mother Tongue: A Case Study of two Schools in Zimbabwe

O. Busari*, L. Tatira** and A. Madzudzo***

Abstract

The significance of the use of mother tongue in teaching science has been defended in several studies. While there is no doubt that there are studies that have revealed some positive effect of the use of mother tongue in teaching science on students' performance and attitudes compared to English, the fact still remains of the need to standardize scientific concepts in mother tongue within that culture, in order for the system to be able to develop an indigenised scientific terminology for school science teaching. Towards this end, therefore, a survey of "O" level students' translation of some perceived difficult scientific concepts into mother tongue was carried out in Zimbabwe. In the main study, a sample of eighty-eight "O" level General Science students in one urban and one rural public school was administered with a Scientific Terminology in the Mother Tongue Questionnaire (STMTQ) that contained forty terminology in General Science. Using frequency and percentages, the findings reveal that a low percentage of the students have local terminology for the scientific concepts while discrepancies also existed in the translation provided by the respondents. Moreover, some concepts that contextually mean different things in science have the same terminology in the Shona language. The linguistic implications of these translations on their acquisition of scientific concepts are discussed in this paper.

Key words: *mother tongue, scientific terminology, acquisition of scientific concepts*

Introduction

One would like to agree with Bruner (1990) who sees language as a cultural tool that shapes human action and social practice. Since science is a human action and socio-cultural practice, it has its own registers. These registers, according to Strevens (1976), are technical and non-technical.

* The late Professor O. Busari, Dean of Education, University of Lagos, Nigeria

** Senior Lecturer, Department of Curriculum and Arts Education, University of Zimbabwe, P.O. Box MP167, Mt. Pleasant (Harare), Zimbabwe, E-mail: livesontatira@gmail.com

*** Lecturer, Department of Curriculum and Arts Education, University of Zimbabwe, P.O. Box MP167, Mt. Pleasant (Harare), Zimbabwe, E-mail: tashayenyika@yahoo.com

Agreeing with the fact that science is embedded in every culture, then, there should be registers for the science in that culture. The absence of or discrepancy in or inadequate mastery of language of science in a specific culture needed to organise such systems technologically could be a leading hindrance to exploring and exploiting indigenised resources by the people themselves. Often times, the obvious and common socio-political norms in the government and private sectors of such culture is to call on 'those outside that culture', who have mastered the language of science in their culture, to execute capital intensive technological projects. This consistent and persistent action can be de-motivating and even discourage the prospective scientists and technologists available in that country. To produce just scientists and technologists should not be the main vision of African educational policy but to ensure that those produced have indigenised scientific registers that would move for effective technological transformations using the resources in African culture. Thus, it is not an understatement to say that language is a powerful tool for such development.

Perhaps our present situation with respect to scientific and technological advances can be better explained by what Jayaweera (1986) observes. He posits that the world of sub-Saharan people has been sub-conjugated through language and education and he contends that there must be the development of cultural autonomy towards social responsibility.

Without language of science, we cannot make meaning of the world. According to Bruner (1990), the two ways of making sense of the world are the logico-mathematical and the narrative understanding. These two ways of acquiring scientific knowledge if expressed in foreign language to science learners pose some difficulties. Strevens (1976) enumerated problems of teaching and learning science using foreign language. So far, some Asian countries have made attempts to get out of these problems by maintaining English language and developing their own indigenous languages to become as technical as English (Rwambiwa, 2000). Countries, for example Malaysia, Singapore, and Japan, where mother tongue is used, have positive technological expressions to make and technological products to show the world.

The present indigenised technology in Africa could be an evolvement of the extent to which language of science in that Continent is developed and mastered while maintaining English and French. One can equally say of science teaching in African classrooms where English, their second language, is dominantly used. Students in Africa often make little sense of science curriculum content because of the conceptual language discrepancy between what the concept means in English and what it means in the learner's mother tongue. Many researchers have responded to the call by Accra Workshop on language use in science classrooms in Africa (CASME, 1975). Such studies reveal positive effects of the use of mother tongue on students' achievement in science (Fafunwa, 1984: Bamgbose, 1994). In fact it has been shown that it is not only the science teachers and students who experience difficulties in using English language in science teaching-learning process, but also the English and Mathematics teachers as well as students (Jaji & Nyagura, 1989: Ayodele, 1988). It should be known that for an average African student, English language is a second language (L2). A deviation from this normal practice should be observed in science classrooms where multilingualism sets in, producing what Bamgbose (1984) termed the "englishes". This could be a result of the interferences that often create barriers for self-internalisation of scientific and technological concepts and restrict meaningful interactions with reading materials, nature and even in science classrooms.

If what Lyle (2000) discovered about how children make meaning in classroom settings is anything to go by, then, are there some science registers that are partially or completely inexistent in sub-Saharan African culture hindering meaning-making? Or do these registers exist in African culture but contextually mean something else? Or rather is there any need to standardise scientific registers in local languages for the purpose of making meaning from school science language? One of the important cultural advantages of a language is its sense of identity. What identities do Africans posse with respect to technology? Adequate command of language would not only help in general discourse of science but would help in the promotion of the application of its conceptual and substantive structures.

For the Anglophone countries in sub-Saharan Africa, another call for the use of mother tongue in teaching science, among others, has been made after two decades of the first call in 1975 (Accra declaration, 1996). African Ministers of Education conference in Accra, Ghana re-emphasised their deep conviction that the promotion and use of the African national languages in formal and non-formal education will ensure a greater efficiency in their learning in and outside school as well as a greater success in the training of human resources and consequently drawing fully on the potentials of African countries for endogenous, ecological, social, and cultural development. In words of Lyle (2000), narrative understanding of science is a key aspect of meaning making.

Some language reflections have been made in educational policies of some sub-Saharan African countries. Following these language policies in some sub-Saharan African countries, there are pieces of evidence indicating the use of both L2 and L1 in science classrooms (Barnes, Britton & Rosen, 1969). Banes, et al (1969) have revealed that teachers sometimes forgot they were not communicating with the majority of the learners. However, there is a need to ensure for the adequacy, accuracy and precision of the local vocabularies and meanings of scientific terminology used by both teachers and students. While there is a need to develop our language technologically, two major aspects of language communication problems must be borne in mind and addressed urgently: (I) technical problem, that is how accurate are the symbols, logarithms, and the vocabularies translated into indigenous languages by both the students and teachers; and (II) semantic problem, that is how precisely do these translations convey the desired meanings (Rwambiwa, 2000). Moreover, the various studies conducted so far did not examine how much of these registers the learners possessed in their mother tongue before we now talk of its use as currently done in some Zimbabwean schools. The issue that standardised registers of scientific concepts are required is indisputable. It is in this context that these researchers attempted to uncover the adequacy and appropriateness of discrepancy of some scientific terminology that students could translate in their mother tongue and the corresponding meanings conveyed by the vocabularies. A further step would be taken to provide linguistic suggestions to these translations.

This paper explores students' local terminology of some scientific concepts in "O" level school science curriculum and determines the extent to which scientific terminology could be attained in local language. It further explains the possible interferences that could contribute to the students' translations and meanings given to some scientific concepts in local languages and suggests some linguistic local scientific terminology for teachers and students of science for standardisation.

Method

The study employed a simple comparative group survey design, in which a school each of two differentiated settings was randomly selected for the purpose of finding out the amount of vocabulary they possess in their mother tongue.

Sample

There are 10 educational regions in Zimbabwe. Two regions were randomly sampled. These were Mashonaland East and Harare. Harare is purely urban. It was purposively indicated that public schools in Harare and Mashonaland East be listed out for selection. One school was randomly picked for Harare region. The public schools in Mashonaland East were stratified into urban and rural. Only one school was randomly selected from the list of rural schools in the latter. Permission was sought from the

Education Districts of these two regions. One rural school and one urban school were randomly selected from the schools in the two regions because this study involved two systematic procedures of developing the instrumentation. For the pilot study only one hundred and seventy six learners in the two schools participated while for the main study, the entire 45 form IV ("O" level) General Science pupils of Murape Secondary School in Mashonaland East and 43 form IV "O" level General Science pupils of Mount Pleasant High School in Harare, whose mother tongue is Shona, participated in the study. Their ages ranged from 16 – 19 year.

Instrument

Two instruments were used in this study. The first one was named 'Language Difficulty Questionnaire' (LDQ) and the second one the 'Scientific Terminology in the Mother Tongue Questionnaire' (STMTQ). The LDQ was developed from a close observation of teachers' lessons for five weeks in each of the two schools. Mondays and Wednesdays were scheduled for classroom observations in Murape High School while Tuesdays and Thursdays were for Mount Pleasant High school. Cassette tape recordings were made of the three different teachers' lessons in each school for the purpose of extracting terminology recently taught and comparing notes when the learners' responses to LDQ are gathered. In all six arms participated in the observation and the LDQ. The LDQ, which contained two parts, served as a pilot instrument for developing STMTQ. From the tape recordings, 130 registers were extracted. The six arms of learners (176 learners) were asked at the end of the classroom observations to respond to the LDQ. Part A of five closed items asked for name of school, age, class, mother tongue, and school science subject. Part B consisted of 130 corpus classified as biological, physical, and chemical to which learners were to indicate level of understanding. The subject were to indicate their responses on a 5- point scale (very easy to understand = 1 point; easy to understand = 2 points; not sure = 3 points; difficult to understand = 4 points; and very difficult to understand (of 5 points). It took a maximum of three days to retrieve the LDQ from the students.

After the analysis the STMTQ was developed and contained two parts. Part A requested for the pupils' bio-data such as name of school, age, class, mother tongue, and parental occupation. Part B contained only one item that asked the students to translate 60 scientific registers, identified as very difficult by the majority and some few ones as very difficult when least expected by the minority, into Shona and define all these in English. The validation of the construct and content of the instrument was carried out by two university physical scientists and one biology secondary school teacher. All the questionnaires were completed and returned immediately in both schools with the assistance of their teachers. The responses of the students were analysed by descriptive statistics and by means of critical reflection by science and language lecturers. The translations of the scientific concepts were pooled together and linguistic explanations were provided on the translations by the researchers.

Findings

Findings in this section are presented in two manners. The first covered results obtained from pilot study while the second covered report of the main study. The results of the pilot study are as follows;

The frequency and percentages of their responses were computed and are as shown in Table 1.

Table 1: Frequency of Responses and Percentages on Learning Difficult of Scientific Concepts in the Two Schools

S/N	Items	Very Easy	Easy	Undecided	Difficult	Very difficult
1	Tree	86 (48.9)	55(31.25)	19(10.8)	11(6.3)	05(2.8)
2	Growth	63(35.8)	71(40.3)	08(4.6)	14(8)	20(11.4)
3	Respiration	23(13.1)	47(26.7)	13(7.4)	72(41)	21(11.9)
4	Germination	28(15.9)	42(23.9)	50(28.4)	29(16.5)	26(14.8)
5	Plants	79(44.9)	54(30.7)	16(9.1)	21(11.9)	06(3.4)
6	Seedlings	23(13.1)	46(26.1)	14(8)	43(24.4)	50(28.4)
7	Health	76(43.1)	20(11.4)	48(27.3)	25(14.2)	07(4)
8	Diseases	85(48.2)	33(18.8)	23(13.1)	33(18.8)	02(1.1)
9	Stem	52(29.6)	79(44.9)	10(5.7)	25(14.2)	10(5.7)
10	Insects	65(36.9)	17(9.7)	43(24.4)	25(14.2)	26(14.8)
11	Tissue	22(12.5)	41(23.2)	42(23.9)	50(28.4)	21(11.9)
12	Cell	38(21.6)	37(21.0)	55(31.3)	22(12.5)	22(12.5)
13	Organs	72(41)	26(14.8)	31(17.6)	29(16.5)	18(10.2)
14	Erosion	13(7.4)	38(21.6)	24(13.6)	77(43.75)	24(13.6)
15	Starch	96(54.6)	57(32.4)	05(2.8)	12(6.8)	06(3.4)
16	Pollution	87(49.4)	42(23.9)	09(5.1)	29(16.5)	10(5.7)
17	Mosquito	103(58.5)	53(30.1)	10(5.7)	06(3.4)	04(2.3)
18	Environment	120(68.2)	43(24.4)	05(2.8)	08(4.6)	-(0)
19	Surrounding	86(48.9)	76(43.2)	02(1.14)	11(.6.3)	01(0.57)
20	Food	86(48.9)	71(40.3)	12(6.8)	05(2.8)	-(0)
21	Hybrid	24(13.6)	33(18.8)	13(7.4)	66(37.5)	40(22.7)
22	Seeds	41(23.3)	109(61.9)	20(11.4)	04(2.3)	02(1.1)
23	Fruits	19(10.8)	98(55.7)	13(7.4)	27(15.3)	19(10.8)
24	Pollination	110(62.5)	55(31.3)	11(6.3)	-(0)	-(0)
25	Reproduction	38(21.5)	26(14.8)	02(1.1)	65(36.9)	45(25.6)
26	Nectar	70(39.8)	65(36.9)	34(19.3)	06(3.4)	01(0.57)

S/N	Items	Very Easy	Easy	Undecided	Difficult	Very difficult
27	Capillary	75(42.6)	46(26.1)	31(17.6)	14(8)	10(5.7)
28	Soil	136(77.3)	40(22.7)	-(0)	-(0)	-(0)
29	Involuntary	12(6.8)	38(21.6)	11(6.3)	80(45.5)	35(19.9)
30	Cash	148(84.1)	24(13.6)	04(2.3)	-(0)	-(0)
31	Storage	111(63.1)	58(33.1)	07(4)	-(0)	-(0)
32	Flies	132(75)	40(22.7)	01(0.57)	02(1.1)	02(1.1)
33	Reflex	57(32.4)	34(19.3)	40(22.7)	36(20.5)	09(5.1)
34	Post-natal	83(47.2)	53(30.1)	28(15.9)	11(6.3)	01(0.57)
35	Budding	126(71.6)	37(21)	08(4.6)	03(1.7)	02(1.1)
36	Flooding	112(63.6)	51(28.9)	08(4.6)	05(2.8)	-(0)
37	Absorption	23(3.1)	29(16.5)	32(18.2)	56(31.8)	36(20.5)
38	Conservation	45(25.6)	87(49.4)	22(12.5)	20(11.4)	02(1.1)
39	Fertilizers	86(48.9)	73(41.5)	03(1.7)	11(6.3)	03(1.7)
40	Twins	145(82.4)	31(17.6)	-(0)	-(0)	-(0)
41	Variation	11(6.3)	28(15.9)	33(18.8)	65(36/9)	39(22.2)
42	Flower	120(68.2)	52(29.6)	-(0)	04(2.3)	-(0)
43	Worm	21(11.9)	80(45.5)	43(24.4)	20(11.4)	12(6.8)
44	Pulse	36(20.5)	111(63.1)	19(10.8)	28(15.9)	01(0.57)
45	Vertebrate	42(23.9)	64(36.4)	20(11.4)	17(9.7)	33(18.8)
46	Heat	160(90.1)	15(8.5)	01(0.57)	-(0)	-(0)
47	Condensation	48(27.3)	22(12.5)	14(7.96)	71(40.3)	21(11.9)
48	Compression	11(6.3)	20(11.4)	26(14.8)	52(29.6)	67(38.1)
49	Gaseous	41(23.3)	55(31.3)	05(2.8)	52(29.6)	23(13.1)
50	Mass	07(4)	27(15.3)	23(13.1)	42(23.9)	77(43.8)
51	Balance	53(30.1)	31(17.6)	02(1.1)	51(29)	39(22.2)
52	Attraction	61(34.7)	27(15.3)	33(18.8)	45(25.6)	10(5.7)
53	Oxygen	106(60.2)	38(21.6)	11(6.3)	15(8.5)	06(3.4)
54	Separation	115(65.3)	59(33.5)	02(1.14)	-(0)	-(0)
55	Burning	33(18.8)	12(6.8)	34(19.3)	55(31.3)	42(23.9)
56	Solution	40(22.7)	56(31.8)	04(2.3)	50(28.4)	26(14.8)
57	Liquid	18(10.2)	111(63.1)	14(7.96)	21(11.9)	11(6.3)
58	Equilibrium	11(6.3)	53(30.1)	89(50.6)	22(12.5)	01(0.57)
59	Suspension	62(35.2)	67(38.1)	26(14.8)	15(8.5)	06(3.4)
60	Air	100(56.8)	65(36.9)	11(6.3)	-(0)	-(0)
61	Ore	05(2.8)	106(60.2)	10(5.7)	34(19.3)	21(11.9)
62	Decompose	23(14.8)	104(59.0)	45(25.6)	03(1.7)	01(0.57)
63	Dissociate	15(8.5)	87(49.4)	30(17.1)	33(18.8)	11(6.3)
64	Malleable	10(5.7)	56(31.8)	66(37.5)	17(9.7)	27(15.3)
65	Crystallization	03(1.7)	26(14.8)	45(25.6)	82(46.6)	20(11.4)
66	Temperature	34(19.3)	70(39.8)	51(29.1)	34(19.3)	23(13.1)
67	Mixtures	98(55.7)	67(38.1)	-(0)	01(0.57)	-(0)
68	Compounds	101(57.3)	43(24.4)	02(1.14)	09(5.1)	21(11.9)
69	Chromatography	22(12.5)	30(17.1)	58(32.9)	29(32.9)	37(21)
70	Iron	41(23.2)	53(30.1)	24(13.6)	45(25.6)	13(7.4)

S/N	Items	Very Easy	Easy	Undecided	Difficult	Very difficult
71	Copper	60(34.1)	49(27.8)	21(11.9)	33(18.8)	13(7.4)
72	Salts	109(61.9)	57(32.4)	10(5.7)	-(0)	-(0)
73	Volume	68(38.6	22(12.5)	82(46.6)	03(1.7)	01(0.57)
74	Collision	40(22.7)	56(31.8)	36(20.5)	31(17.6)	13(7.4)
75	Particles	22(12.5)	15(8.5)	43(24.4)	67(38.1)	29(32.9)
76	Change	97(55.1)	57(32.4)	11(6.3)	05(2.8)	06(3.4)
77	Energy	52(29.6)	20(11.4)	47(26.7)	35(19.9)	22(12.5)
78	Matter	123(69.9)	28(15.9)	12(6.8)	23(13.1)	-(0)
79	Reversible	16(9.1)	12(6.8)	57(32.4)	34(19.3)	67(38.1)
80	Acids	68(38.6)	56(31.8)	19(10.8)	21(11.9)	12(6.8)
81	Metals	05(2.8)	45(25.6)	31(17.6)	62(35.2)	33(18.8)
82	Steam	58(33.1)	90(51.1)	07(4)	12(6.8)	09(5.1)
83	Expansion	34(19.3)	95(54.1)	22(12.5)	20(11.4)	05(2.8)
84	Standard	27(15.3)	23(13.1)	45(25.6)	55(31.3)	26(14.8)
85	Ionise	34(19.3)	21(11.9)	89(.50.6)	18(10.2)	14(8.1)
86	Colloids	51(29.1)	34(19.3)	52(29.6)	16(9.09)	23(13.1)
87	Constituents	32(18.2)	41(23.3)	45(25.6)	25(14.2)	33(18.8)
88	Constant	46(26.1)	45(25.6)	30(17.1)	42(23.9)	13(7.4)
89	Point	87(49.4)	56(31.8)	05(2.8)	23(13.1)	05(2.8)
90	Images	100(56.8)	45(25.6)	11(6.3)	20(11.4)	-(0)
91	Force	99(56.3)	34(19.3)	06(3.4)	12(6.8)	25(14.2)
92	Friction	22(12.5)	22(12.5)	11(6.3)	54(30.7)	67(38.1)
93	Object	32(18.2)	71(40.3)	29(16.5)	23(13.1)	21(11.9)
94	Gravity	12(6.8)	45(25.6)	06(3.4)	82(46.6)	31(17.6)
95	Heat	48(27.3)	20(11.4)	31(17.6)	54(30.7)	23(13.1)
96	Insulate	23(13.1)	19(10.8)	33(18.8)	48(27.3)	53(30.1)
97	Engine	07(4.1)	08(4.6)	10(5.7)	51(29.1)	100(56.8)
98	Current	26(14.8)	21(11.9)	12(6.8)	55(31.3)	62(35.2)
99	Scale	30(17.1)	37(21)	54(30.7)	36(20.5)	19(10.8)
100	Pressure	20(11.4)	33(18.8)	23(13.1)	57(32.4)	43(24.4)
101	Machine	40(22.7)	30(17.1)	12(6.8)	41(23.3)	53(30.1)
102	Illumination	06(3.4)	23(13.1)	05(2.8)	70(40)	72(41)
103	Density	63(36.1)	51(29.1)	22(12.5)	23(13.1)	17(8.1)
104	Velocity	59(33.5)	45(25.6)	07(4)	12(6.8)	53(30.1)
105	Speed	52(29.6)	38(22.1)	13(7.4)	23(13.1)	22(12.5)
106	Plug	110(62.5)	44(25)	09(5.11)	10(5.7)	03(1.7)
107	Circuit	28(15.9)	12(6.8)	20(11.4)	71(40.3)	45(25.6)
108	Measure	81(46)	60(34.1)	05(2.8)	23(13.1)	07(4)
109	Weight	30(17.1)	42(24.1)	23(13.1)	45(25.6)	36(20.5)
110	Quantity	56(31.8)	67(38.1)	23(13.1)	16(9.1)	14(8.1)
111	Upthrust	21(11.9)	25(14.2)	35(20.1)	42(23.9)	53(30.1)
112	Curve	99(56.3)	45(25.6)	01(0.57)	12(6.8)	19(11.1)
113	Motion	23(13.1)	77(44.1)	19(11.1)	20(11.4)	37(21)
114	Proportionality	98(56.1)	45(25.6)	01(0.57)	21(11.9)	11(6.3)

S/N	Items	Very Easy	Easy	Undecided	Difficult	Very difficult
115	Power	19(11.1)	45(25.6)	02(1.14)	66(37.5)	44(25)
116	Work	20(11.4)	23(13.1)	12(6.8)	82(46.6)	39(22.2)
117	Space	20(11.4)	22(12.5)	40(22.7)	57(32.4)	37(21)
118	Field	11(6.3)	23(13.1)	39(22.2)	56(31.8)	47(26.7)
119	Sound	23(13.1)	67(38.1)	23(13.1)	51(29.1)	12(6.8)
120	Potential	20(11.4)	34(19.3)	35(20.1)	45(25.6)	42(24.1)
121	Pull	95(54.1)	44(25)	21(11.9)	17(10.1)	09(5.1)
122	Kinetic	49(27.8)	56(31.8)	34(19.3)	22(12.5)	15(8.5)
123	Electron	41(23.3)	18(10.2)	24(13.6)	59(33.5)	34(19.3)
124	Humidity	90(51.1)	45(25.6)	22(12.5)	17(10.1)	02(1.14)
125	Shadows	57(32.4)	81(46)	05(2.8)	21(11.9)	12(6.8)
126	Oscillations	35(20.1)	15(8.5)	13(7.4)	43(24.4)	70(40.1)
127	Length	112(63.6)	23(13.1)	01(0.57)	05(2.8)	35(20.1)
128	Solar	79(45.1)	76(43.2)	11(6.3)	02(1.14)	08(4.6)
129	Distance	82(46.6)	45(25.6)	07(4)	23(13.1)	19(11.1)
130	Echo	30(17.1)	21(11.9)	24(13.6)	42(23.9)	59(33.5)

The scientific concepts were categorized as biological, physical and chemical terms. Table 1 shows that about 40 registers were found difficult especially when a respondent was undecided or found it difficult to learn. It was also found that some concepts that are fundamental in General Science were perceived as difficult by some of the respondents. Some of these are food, health, energy, quantity, to mention just a few. Some of these were listed along with the perceived difficult concepts for translation. Out of the sixty registers given, table 2 reveals the percentage of concepts by category that can be translated into Shona by the sample.

Table 2: Percentages of Concepts Available in Shona

S/N	Available A B C P	Non-available N A B C P
Urban (130)	23(17.7) 19(14.6) 11(8.5)	22(16.9) 23 (17.7) 32(24.6)
Rural (150)	41(27.3) 35(23.3) 09(6)	4(2.67) 27(18) 34(22.7)

The respondents could not translate twenty of the sixty concepts in the Shona language. These were electron, oscillations, potential, echo, current, gravity, friction, circuit, chromatography, crystallization, particles, organs, capillary, cell, reflex, malleable, pulse, variation, metal and standard. For the forty concepts translated, appropriate translations by pupils are in bold, while inappropriate words are underlined and suggested alternatives are in italic.

Under measurement, general to all the three categories:

1. Density – **uremu, huremu**
2. Volume – **huremu uremu,** *ufemu, kufuta*
3. Mass – huremu, uremu, huwandu, *kurema*
4. Measure – kurera, kuyera, kupima, **era, yera**, *pima, chipimo*
5. Weight – kurema, uremu, huremu, *simba rekurema*
6. Balance – kuenzana, **chikero, sikero, chiyero**
7. Quantity – **huwandu, uwandu,** mwando
8. Distance – **chinhambwe, urefu, hurefu**

Under biological terms:

9. Germination – **kubuda, kumera**
10. Food – **zvekudya, chikafu, chekudya**
11. Absorb – kutora, kumedza. *Sveta*
12. Hybrid- mbeu yakanaka, mbeu, mbeu yapamusoro, mbeu hombe yakanaka *masanganiswa*
13. Health – **utano, hutano**
14. Respiration – **kufema**
15. Insect –**kapuka, kapukanana, chipukanana,** tupukanana
16. Seedling – mbeswa, mbesa, **nhondo**
17. Tissue – ganda, makanda, *tishu*
18. Involuntary – kuita chinhu pasina chinokudzivisa, pasina zvinokukanganisa. *Garukawaita*
19. Erosion – kukukurwa, kueredzwa, gukurahundi, **gukuravhu**
20. Burning – **kubvira, kupisa, kutsva.**
21. Attraction – kutorwa moyo, kuyevedza, kukwezva, *gwezvo, hwezvo.*
22. Reversible – kuchinjika, kudzokorodza, kudzokera. *Kudzosereka sezvazvanga zviri*

Under chemical terms:

23. Solution – **mhinduro**, *surudzo*
24. Liquid – **mvura-mvura,** zvisanganiswa, mvura, mumvura
25. Equilibrium – **kuenzana**, *mangange*
26. Gaseous – hutsi, muutsi, utsi, mweya, *mweya-mweya*
27. Suspension – kusanyura, kuzorodzwa, kumiswa, y*angararo*

Under physical terms:

28. Work – **basa**
29. Energy – simba, *masimba*
30. Sound – kutinhira, **mutinhimira,** ruzha, maungira, kutinhimira
31. Power- simba, masimba, *shandiso yemasimba*

32. Solve- **gadziridza**, kugadziridza, kunhadzirisa, *nhadzirisa*
33. Engine – muchina, **injini, hinjini**
34. Field – **munda,** *nharaunda, nzvimbo*
35. Condense – kubatanidza, kondenzi
36. Wind – **mhepo**
37. Insulate – chokuvharidzira, kubata, chekuvhara*, putira*
38. Upthurst – kufa chinhu, kuvimbika, chekuvhara, *simudzo*
39. Space – **nzimbo isina chinu, nenzvimbo**, *panhu*
40. Compress – kudzvanyirira, kukwiza, kukwizana, kumanikidza, pusha, *dzvanya*

From the analysis in Table 2, it shows that the respondents have difficulty in translating mainly the physical chemistry concepts into Shona. The same translation was given to some scientific concepts that contextually mean different things. Of the 40 concepts attempted only 60 percent were appropriately translated by the pupils.

Recommendations

Our recommendations in this paper are as follows:

- Science should be taught through the medium of indigenous language.
- Scientific terms should be standardised first.
- The corpus should be collected from schools by both science and language specialists, then decide which terms to use for science teaching.
- Where there is no equivalent term in the indigenous language, such terms should be adopted directly from the English words although this should be done sparingly.
- As far as possible, paraphrasing of terms should be avoided during translation, in order not to interfere too much with the syntax of science.
- The coinage of new terms should be given preference ahead of either paraphrasing or adoption.
- The use of indigenous language in science education should be done in phases, starting experimentally at junior high school.
- For further study, an enhanced instrument of interview would be needed for instance discourse on the concepts in order to assess the direction of understanding.

References

Accra Declaration. (1996). Pan African Seminar on the Problems and Prospects of the Use of African Languages in Education, Accra, Ghana.

Ayodele, S. O. (1988). The Problem of Language for Educating Nigerian Learners. *Faculty of Education Series*, 4. Nigeria, University of Ibadan.

Bamgbose, A. (1994). Mother-tongue Medium and Scholastic Attainment. In *Prospects,* 14:87–93. Ibadan, Nigeria.

Bruner, J. (1990) *Acts of Meaning*, Cambridge, M.A.: Howard University Press.

Commonwealth Association for Science and Mathematics Education. (CASME). (1975). Languages and the Teaching of Science and

Mathematics with Rpecial Reference to Africa Report of a Regional Workshop Held in Accra, Ghana.

Jaji, G. & Nyagura, L. M. (1989). Attained Mathematics Curriculum in Zimbabwe Primary Schools. *Zimbabwe Journal of Educational Research,* 2(2). University of Zimbabwe, Harare.

Jayaweera, N. (1986). *The Third World and the Political Economy of the Communication: Revolution Communication and Domination*, Ife, Nigeria.

Fafunwa, B. (1984). Education in the Mother Tongue: A Nigerian Experimentation on the Six Year (Yoruba Medium). Primary Education Project at the University of Ife. *West African Journal of Education,* 19:125. Ibadan.

Rwambiwa, J. P. T. (2000). African must Overcome Language Barrier to Defeat Consumerism. The Sunday Mail, April, Harare, Zimbabwe.

Strevens, P. (1976). Problems of Learning and Teaching Science through a Foreign language.*Studies in Science Education,* 3:55–60. Nigeria.