

The Use of Lingála in the Teaching of Chemistry in DR Congo: A Socio-terminological Approach

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1. Introduction

Our research focuses on the use of Lingála as a vehicular language for the teaching of chemistry in the city of Kinshasa, the capital of DR Congo. Lingála, one of the four national languages (i.e., Kikongo, Kiswahili, Lingála, and Cilubà) of Congo, is the most widespread language of daily communication in Kinshasa, the capital of the country, a city with an estimated population of 9 million inhabitants. Lingála is also the language most used in Congolese music, theatre, movies, radio and TV. For these reasons among others, Lingála has been spreading much more rapidly than its national counterparts (i.e., Kikongo, Kiswahili, and Cilubà).

Kinshasa students speak Lingála in their daily life, but in the classroom French is the language of instruction. In most African countries, former colonial languages continue to be used as languages of instruction (LOI) in the school system, especially in the scientific courses in secondary schools and in universities. One of the claims advanced for that practice in predominantly stable multilingual countries, even where there are widely spoken indigenous languages (such as Lingála and Kiswahili in DRC, Bamana in Guinea and Mali, and Wolof in Senegal) is that African languages have not developed scientific and technical vocabularies to accommodate teaching in these fields. The lack of adequate terminology reportedly makes it difficult for teachers and researchers to work in their mother tongues (L1). On the other hand, many studies reveal that the general public has a poor command of LOIs.

In our opinion, there are at least two solutions to this problem. The first is the much explored path of reinforcing the command of French, English or Portuguese by African students. The second is the less explored path of testing whether it would be possible and beneficial to create or reinforce scientific terminology in African major national languages.

In this paper we strive to explore the second path. We argue that the use of the students' daily language as the language of instruction is a didactic approach which would allow them to better appropriate the knowledge taught at school. This is especially true, we argue, when it comes to the sciences. However, Lingála speakers often have themselves a negative attitude towards that language and its possibilities.

This paper is a contribution to code elaboration aiming to empower African languages. It describes a way to coin chemistry terms in Lingála and to make them available to the teachers and students of secondary schools. In the last part of the paper we analyze the users' attitudes vis-à-vis the presence of Lingála in a school text. What this paper strives to prove, along with a few other publications on African languages (CELTA 1995-2000, BAKITA 1972-2004, TAMA 2003, Bamgbose 1984), is that : (1) it is relatively easy to coin relevant terms for any scientific or technical field; (2) it is important and beneficial to foster the importance of such coinage in the target language and improve the users'

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positive attitude towards it ; and (3) it is essential to enlist the commitment of the target language's speakers to pursue this type of work and to use the resulting terms once they have been developed. It also argues that terminology work plays an important role in reinforcing positive attitudes towards the use of African languages in the school system.

Discussion and analysis in this paper are structured as follows: Section (2) presents a sociolinguistic overview of language practices in Kinshasa schools. Section (3) discusses different co-habiting varieties of Lingála, focusing on some registers of the variety spoken in the city of Kinshasa. Based on a 2008-2011 survey, Section (4) examines the register used by Kinshasa teachers in chemistry lessons. Section (5) explains the methodology we have adopted for coining chemical terms in Lingála and the results thereof. Section (6) outlines the methodology we have applied for the dissemination of that terminology. In the final part, we will then draw some conclusions.

2. Sociolinguistic framework

When DR Congo was under Belgian colonial rule, four Congolese languages (i.e., Kikongo, Kiswahili, Lingála, and Cilubà) were chosen as lingua franca with a regional area for each one. School authorities also allowed the use of these languages as media of instruction in primary school, up to the 5th grade especially in the rural areas. Selected major ethnic languages (e.g., Lomongo, Kitetela, Zande, Ngbaka) were also used for that purpose up to the third grade. French was taught as a subject at those levels, and then used as language of instruction from the third year of primary school. At secondary school and university, only French was used as the language of instruction. After the advent of independence and following the introduction of the so-called *système métropolitain* in 1957, the Congolese government chose to use French as the sole language of instruction (Bokamba 2008). The Mobutu era, however, saw the rise of the authenticity doctrine, which called for Africans to turn back to their ancestral cultural traditions. In this context, the first congress of Congolese linguists took place in the city of Lubumbashi in 1974. Following the recommendations of the congress, the government launched a new language policy prescribing the use of the four Congolese national languages as media of instruction for all courses from primary school through the 2nd year of secondary school, and thereafter for selected courses, with French being taught as a subject from the 3rd grade onward. That policy, nevertheless, has never been implemented consistently, and French has maintained its unperturbed role as virtually the sole medium of instruction in the school system throughout the cities in DR Congo, including Kinshasa (Nsuka 1987, Bokamba 2008a-b, 2009).

In 1985, the second congress of Congolese linguists debated again the importance of using national languages at school (CELTA 1987). In 1986, the government passed the *Loi-cadre de l'enseignement* 'the basic law of education', organizing education in DR Congo. In its Article 120, that law provides for the use of French and Congolese languages as languages of instruction (Loi-cadre 1986). In spite of this, as French retains a position of prestige in the linguistic attitudes of Congolese speakers, school authorities, inspectors, teachers, parents and students behave as if these laws instituted monolingualism in schools, with French as the sole language of teaching.

However, that linguistic representation has proved to be ever increasingly detached from actual language practice. Indeed, for several decades now, a great number of sociolinguistic studies, dating back to at least the 1970s, have consistently reported a poor command of French by pupils and the ever spreading use of Lingála by students and teachers in the city of Kinshasa (Nkenda 1971, Nsuka 1987, Nyembwe 2004, Manduku 2004, Bokamba 2009). As a consequence, at present, French serves as the language of instruction and Lingála maintains its role as the default language of daily communication.

The sociolinguistic situation of Kinshasa, therefore, is characterized by a diglossic communication system, where French plays the role of 'high' language and Lingála plays the role of 'low' language. As shown elsewhere (Sene Mongaba 2011), now, in Kinshasa classrooms, the diglossic situation concerns the allocation of didactic functions of the same course between two languages, French and Lingála. French plays the role of written language (the course notes) and Lingála plays the role of oral language (the explanations of those course notes).

Before describing the socio-terminological aspect of our work, we would like to briefly review the Lingála varieties and registers as described in the sociolinguistics literature and by our own observations.

3. Lingála varieties and registers

Lingála is commonly acknowledged to have four main varieties (Bokula 1983, Edema 1994, Motingea 2006, Bokamba 2009, Meeuwis 2010, Sene Mongaba 2010) : (1) *Lingála lya Mankanza* (LM), associated with the Catholic church who ‘standardized’ it; (2) *Current* or *Spoken Lingála* (CL), associated with the Protestant church ; (3) *Lingála ya Kinshasa* (LK) recently documented in novels, manuals and the 2004 Protestant Bible ; and (4) *Bangála*, studied more recently by Edema (1994). The last variety will not be dealt with here: we will focus only on the first three with regard to the use of the language in Kinshasa, with special emphasis on some registers of LK.

3.1. *Lingála lya Mankanza (LM)*

Considered as the ‘pure’ variety, *Lingála lya Mankanza* uses a full range of subject-verb agreement (SVA), as well as a full range of noun class grammatical agreement involving all modifiers (i.e., adjectives, demonstratives, quantifiers, and possessives). It also uses object markers, vocalic harmony and a 7-vowels system (a, i, e, ε, ə o, u), i.e. the contrast between the close-mid and open-mid vowels is distinctive. The passage in (1) below illustrates the grammatical agreement across the agreement system in this variety:

(1)

Mayébi ma kemí pé maloba masúsu mazalí o monoko mwa lifalansé kasi loléngé loye masakólá matongámá matikáli o Lingála. Yangó ezalí na ntína ya kosunga bána ba kelási ‘tè bábúngana té o matéya ma bangó. Báyéba makambo maye bazalí kotánga mazalí esiká nini o ntei ya matéya ma bangó.

For example, the possessive connector {ma-} in the phrase ‘mayébi ma kemí’ (lit. ‘knowledge of chemistry’) matches the class of *mayébi* ‘knowledge’ in (1). The plural noun prefix of *mayébi* {ma-} corresponds to class 6.

Likewise, in the phrase *monoko mwa lifalansé* (lit., ‘language of French’), the possessive connector *mwa* agrees in class with the word *monoko* ‘language’. The noun prefix is {mo-} corresponding to class 3. *Mwa* is the contraction of *mo-a*.

In (1), the full range of agreement is shown in the phrase *maloba masúsu mazalí* (lit. ‘words others are’). The adjective *masúsu* (lit. ‘others’) and the verb *mazalí* (lit. ‘are’) take the noun prefix {ma-} of the subject *maloba* (lit. ‘words’). In the singular, it would be: *liloba lisúsu lizalí* (lit. ‘word other is’). In this case, {li-} is the singular noun prefix of class 5.

3.2. *Current or Spoken Lingála (CL)*

Current Lingála is the variety spoken in the Equateur and Oriental provinces. It exhibits a partial but close to full SVA, and a significantly reduced grammatical agreement elsewhere. It also uses vocalic harmony and a 7-vowels system (a, i, e, ε, ə o, u), as described above for LM. Its somewhat reduced grammatical agreement, especially concerning modifiers, is illustrated in (2):

(2)

Mayébi ya kemí mpé maloba mosúsu mazalí na monoko ya lifalansé kasi loléngé masakólá matongámá, matikáli na Lingála. Yangó ezalí na ntína ya kosunga bána kelási éte bábúngana té na matéya na bangó. Báyéba makambo óyo bazalí kotánga mazalí esiká nini na matéya na bangó.

In contrast with the example for LM in (1), with example (2) in CL, a generic form of the possessive connector *ya* is used regardless of the noun class of the possessive noun (e.g. *mayébi ya kemí, monoko ya lifalansé*). The combination of SVA and reduced grammatical agreement occurs in the phrase *maloba mosúsu mazalí*, where the noun prefix of the adjective *mosúsu* does not agree with the noun prefix {ma-} of the subject *maloba* while this is the case with the verb prefix *mazali*.

3.3. *Lingála ya Kinshasa (LK)*

Lingála ya Kinshasa is the Lingála spoken in the cities of Kinshasa, Brazzaville and, because of its increasing spread, also in many cities and rural communities of Congo, as well as by the Congolese Diaspora around the world. For our purposes here we do not expressly distinguish LK from its Brazzaville counterpart, because of the minor differences that exist between them. The different features we describe below are applicable to both.

LK has a 5-vowels system (a, e, i, o, u). It presents a more extended reduction of the agreement system than Current Lingála; namely, SVA is limited to human/animal singular and plural (*a-sekí* vs. *ba-sekí* – noun classes 1 and 2), and for everything else the subject prefix {e-} is used for both singular and plural. All modifiers become invariant irrespective of the noun class. LK exhibits double noun prefixes in most non-human classes (e.g., *bama-kambo* ‘affairs’, instead of *ma-kambo*; *ba-bi-lóko* ‘things/objects’ vs. *bi-lóko*) (Sesep 1978, Bokamba 1993). With respect to lexicon, LM and CL are mostly self-reliant when it comes to creating neologisms or drawing them from closely related Bantu languages from the Equateur province; LK relies extensively on Kikongo, Cilubà, Kiswahili and French, including the borrowing of phrases. Kinshasa Lingála is characteristically a highly code-mixed variety involving Lingála and French (Vatomene 1983). Registers of this variety can be characterized as depending on the extent of the use of French vocabulary in code-switching/mixed Lingála-French in a sort of continuum, as we describe below.

The register we would define as *Lingála ya sólo - Ls* – (different to LM or CL as documented above) is the elaborate register of Lingála (LK). It is infrequent to meet someone speaking *Ls* in Kinshasa, but it is considered as the ideal variety. French terms for numbers, colours and units of sizes (in phonologically integrated form) and other words that are non-indigenous to Lingála and closely related languages are considered as borrowed and not code-mixed words. *Ls* is what is recently (after 2000) used for writing books of various sorts, including novels, textbooks, the Protestant Bible 2004, etc. In other words, we argue that *Ls* is the written variety of LK, but different to what is documented as LM (*Lingála littéraire*) or CL. The following statement (3) can characterize *Ls*:

(3)

Mayébi ya chimie pé maloba mosúsu ezalí na monoko ya Français kasi ndéngé baphrase etongámá, etikáli na Lingála. Yangó ezalí na tína ya kosunga bána kelási bábúngana té na matéya na bangó. Báyéba makambo óyo bazalí kotánga ezalí esiká níni na matéya na bangó.

In (3), contrary to the example for LM in (1) but similarly to the example for CL in (2), a generic form of the possessive connector (*ya*) is used regardless of the noun class of the possessive noun (e.g. *mayébi ya chimie, monoko ya Français*).

In the phrase *maloba mosúsu ezalí*, the noun prefix {mo-} of the modifier *mosúsu* does not agree with the noun prefix {ma-} of the subject *maloba* as in (2) but, contrary to (2), the verb *ezali* begins by the prefix {e-}.

The French terms in (3), *chimie* ‘chemistry’, *Français* ‘French’ and *phrase* ‘sentence’, are considered as borrowings. However, the term *mayébi* used shows the elaborated code. The form is easily understandable by Lingála speakers. Indeed, *mayébi* is a deverbative noun from the verb stem {-yéb-} (lit. ‘to know’) generated by internal Lingála morpho-semantic process.

In daily conversation on the street and on popular radio-TV talk shows and plays, in contrast, most inhabitants of Kinshasa speak the so-called *Lingála facile* ‘easy Lingála’ (*Lf*) which is a code mixed

variety involving *Ls* and French, as stated above (Motingea 2010). This code switching depends on the educational level of a speaker or his/her aim in the conversation. In the context of training, formal and non formal schools, we also observe that specialised terms are used in French. People write in *Lf* on the Internet (e-mail, chat, forum, blog, Facebook, etc.). The difference between *Ls* and *Lf* is that French terms used in *Ls* are considered as loanwords, e.g. *porte*, *biro*, etc.), whereas in *Lf* there are also French terms or sentences that are not borrowed. Thus, it is not the case that some people always speak *Lf* and others always *Ls* which really represent a continuum that is difficult to distinguish clearly. The following statement (4) can characterize *Lf*:

(4)

Banotion ya chimie pé baparole mosúsu ezalí na Français kasi ndéngé baphrase etongámá, etikali na Lingála. Yangó ezalí na tína ya koaider bána classe bábúngana té na bacours na bangó. Báyéba makambo óyo bazalí kotánga ezalí place nini na cours na bangó.

We observe a high level of French words in example (4): *notion*, *chimie*, *parole*, *Français*, *phrase*, *aider*, *classe*, *cours*, *place*. However, the SVA and grammatical construction matches example (3) of *Lingála ya sóló*.

In addition to the above varieties, a slang of Lingála exists, termed *Indoubill*, which emerged in the 1950s and has been described recently by Motingea (2010). This term is now considered to be old-fashioned. Nowadays, Lingála speakers prefer to refer to it as *Lingála ya bayanké* ‘Lingála of thugs’. Since 2005, another slang variety of Lingála has been reported in Kinshasa, referred to as *Langíla*, which is a kind of encrypted *Lingála ya bayanké*; but neither *Langíla* nor *Lingála ya bayanké* enjoys high status among Lingála speakers.

4. The use of Lingála in Kinshasa schools

In our attempt to ascertain the feasibility of using Lingála to teach chemistry in secondary schools in Kinshasa, the first step we took was to interview teachers, in order to find out if they use it in the classroom or not. If they did, we asked them what variety of Lingála they used and what problems, if any, they faced in teaching chemistry in the language.

From April 2008 to January 2011, we interviewed 54 secondary school teachers. According to our findings, 46 schools out of 54 explicitly obliged students only to speak French and never Lingála at school. However, all of the teachers indicated that in spite of this practice the students had a poor command of French.

Despite the ban on the use of Lingála in class by the students, the teachers reverted to it frequently for explanations. Forty-nine out of fifty-four teachers (i.e., 95%) used Lingála to explain their course before asking students to take notes in French. Five teachers (2 from very selective schools and 3 from schools attended by the affluent classes) do not use Lingála in the classroom. Sixteen out of the 49 who use Lingála use it systematically to explain lessons. Twenty-five use it at least once in each 50-minute lesson when students do not understand the explanation in French; and eight use it occasionally. So we can conclude that Lingála is used in the classroom to explain lessons. None of the 54 teachers stated that Lingála is used to take notes. So presumably Lingála is not used for writing lessons, but we did not seek to verify this claim by checking students’ notes.

All of the 49 teachers who used Lingála in the classroom used *Lingála facile* (*Lf*). We then asked them what variety or register of Lingála was suitable for writing schoolbooks. All of the teachers opted for the use of bilingual French - *Lingála facile*. They chose *Lf* because in it specialised terms are still in French, which makes it closer to the desired content of students’ notes, since according to curriculum courses are supposed to be taught in French. However, the teachers also suggested adding a French-Lingála lexicon for specialised terms, because in their view it would be beneficial, as it would improve their ‘correct’ Lingála (*Lingála ya sóló Ls*). They justified this choice by their negative attitude (as is the case in general for Kinshasa Lingála speakers) towards their own spoken register. As mentioned

above, in the continuum of Lingála, *Lf* is the lowest prestige register, whereas *Ls* is today considered as the elaborate register, though people speak *Lf*. This is why teachers hope for the creation of scientific terminology in Lingála with the aim of using a ‘correct’ Lingála when they want to talk about chemistry in Lingála.

We asked 10 students to read texts in *Ls* and in *Lf*. All of them found it difficult to understand the text in *Ls*. All ten students could easily understand the text in *Lf*. However, all of them thought that the presence of scientific terms in Lingála led them to realize that it is indeed possible to talk about chemistry in Lingála. It could also be argued that the difficulty in reading *Ls* text is due to the fact that Lingála is not taught at school and the relative ease in reading *Lf* is due to the presence of French words, which students have already constantly come across in their notes.

The fact that all of the students concluded that Lingála is not a ‘worthless’ language and that teachers wish that their scientific Lingála could be more developed, allows us to argue that the production of Lingála scientific terminology is important for motivation and self-esteem in the teaching / training process. However, the fact that teachers already use Lingála facile for explaining lessons leads us to conclude that the production of Lingála scientific terminology must not be a precondition for the use of Lingála as a teaching language. With this initial survey information in mind, let us now consider what we did to develop and test the Lingála terminology for teaching chemistry in Kinshasa’s secondary schools.

5. Coining chemistry terms in Lingála

5.1. The case of chemical elements

In order to coin terms for the chemical elements in Lingála, we have adopted the methodology used by Mbikay Diambu Papi¹, based on phonologic integration and loan transfer (he coined the terms for element number 1 to element number 105 and we completed that with elements 106 to 118). For other chemical elements whose existence has long been known in Lingála, the pre-existing Lingála term was maintained. We then updated the global list by taking into account the suggestions collected from chemistry teachers at a conference organized at the University of Kinshasa on 12 November 2008. An excerpt of the final list of chemical elements is shown in **Table 1**, to illustrate our findings:

Table 1. Bilingual list of some chemical elements

Atomic number / Motángo ya atom	Symbol / Elembo	Term in Lingála / Bibéngeli na Lingála	Term in French / Bibéngeli na Français
1	H	Idrojéni	Hydrogène
6	C	Kabóni	Carbone
8	O	Okisijéni	Oxygène
11	Na	Natúlu	Sodium
13	Al	Alumínyu	Aluminium
26	Fe	Likele	Fer
29	Cu	Motáko	Cuivre
79	Au	Wólo	Or
113	Uut	Ununmísáto	Ununtrium

¹ Mbikay is a Congolese engineer who has worked on the development of scientific terms. The results of his work on the nomenclature of the 105 chemical elements were first published in Kawata’s Lingála dictionaries (2003 and 2004). For specific details about the periodic table in Lingála, cf. Sene Mongaba 2009.

5.2. The case of chemical processes, properties and phenomena

Terms for processes, properties and phenomena usually contain an element that gives an idea of the semantic sense of the concept. We therefore tried to coin chemical terms for processes, properties and phenomena by using derivation, composition and loan transfer as intra- and extra- linguistic processing for coining neologisms.

We proceeded as follows: drawing on the school curriculum for first-year chemistry students in secondary school (14-15 year-old students) we prepared lessons in Lingála. Whenever faced with the issue of using a specialised term for a process, property or phenomenon, in order to decide how to coin the term, we started off trying to explain the concept in Lingála. We argue that trying to wholly explain a concept in Lingála spontaneously generates terms in that language, as the fact of working directly in the ‘target language’ allows the native speaker to draw upon his/her subconscious mechanisms to find the right term corresponding to the concept in his/her language. If some terms nevertheless remained elusive, we first checked bilingual dictionaries (Everbroek 1985, Dzokanga 2001, Kawata 2003 & 2004) or we asked other native speakers, Congolese chemists. The mechanisms used for coining terms are, in order of preference, derivation, compounding, loan transfer and borrowing.

The discussion in subsections (5.2.1 & 5.2.2) presents two examples of our reasoning to illustrate our work.

5.2.1. Loan transfer

We intended for example to coin the Lingála term for the chemical concept of ‘Atomic Number’. In French the corresponding term is *Numéro atomique*. We proceeded as follows:

‘Numéro atomique’ ezalí níni ? Numéro atomique ezalí motúya ya baprotón na káti ya mukókólí ya atómi ya ebuki yangó. Elakisaka pé motúya ya baelektron pé esíká ya ebuki na ebuki na káti ya etanda ebandelaka. *Numéro* na Lingála ezalí *motángo* tó pé *nimeró* ndéngé leló óyo liloba wáná ekómá kolobama míngi na esíká ya *motángo*. Na boye, *Numéro atomique* tokokí kosénga bábéngaka yangó *motángo* ya atómi tó pé *nimeró* ya atómi.’

‘What is *numéro atomique*? The *numéro atomique* ‘atomic number’ is the number of protons in the nucleus of an atom of that element. It also shows the number of electrons and the numerical order of each element in the periodic table. *Numéro* ‘number’ in Lingála is *motángo*, or *niméro*, which is a more frequent term today in Kinshasa than *motángo*. So, we can propose to coin ‘atomic number’ as *motángo* ya atómi or *nimeró* ya atómi.’

5.2.2. Derivation

Derivation is a process known and used by Lingála speakers for generating new terms which are meant to be easily understandable by other Lingála speakers. For details about derivation in Lingála, readers can consult Edema (2008).

Liaison chimique ezalí níni ? Baatomi ekanganaka míbalé míbalé pó na kosála bamolekil. Bokási óyo ekangisaka baatomi míbalé yangó ndé ezalí *liaison chimique*. Tángó bokási yangó ezalí, baatomi óyo ezalí ya kokangana.

Na Lingála,

(a) pó na kokela bibéngeli ya boyókani *à partir* ya mobímí ya likelelo (deverbative), babandaka na {li-} (kelási ya 5). Ndakisa : libála ; lisangá, liloba, likanisi.

(b) sókí sóngóló asalí pakala likambo pé pakala asalí sóngóló sé likambo yangó, esuki {-ana} ekobakama na súka ya likelelo yangó. Na boye, epésí bisó likelelo ko-kang-ana. Kokangana epésí li-kang-an-i. Yangó wáná tokosénga *liaison chimique* ébéngama *likangani na kemi*.

‘What is a *liaison chimique* (chemical bond)? Atoms build a bond between them to form a molecule. This force that keeps each pair together is called *liaison chimique*.

In Lingála,

(a) to coin a deverbative noun indicating any kind of relation, one can use the prefix {li-} (class 5)

Example: *li-bála* ‘marriage’; *li-sangá* ‘union’, *li-loba* ‘word’, *li-kanisi* ‘idea’.

(b) a reciprocative verb is formed by suffixing {-ana} to the verb root or derived stem. Using the semantic sense of ‘reciprocal binding’ leads us to the verb *ko-kang-ana*. That is why we proposed the term *likangani na kemi* for ‘chemical bond’ in Lingála.

In most cases, we coined new words by drawing on the existing processes and elements of the language. For example, the prefix {li-} occurs frequently in everyday language in Kinshasa. We have terms like *liyébani*, ‘knowing each other’, *libébani*, ‘having an argument’.

We followed the same reasoning for other terms and we submitted the complete list of chemical terms to 42 chemistry teachers as a multiple choice questionnaire. If more than 35 among them chose our proposal, we considered it as validated. If not, we considered it as invalidated. At the moment 213 chemical terms are validated. **Table 2** below illustrates some of them.

Table 2. Bilingual list of some chemical processes, properties and phenomena (French-Lingála)

FRENCH	LINGÁLA	FRENCH	LINGÁLA
Acide	Aside	Réduction	Bozwi
Atome	Atómi	Soluté	Emelami
Chimie	Kemi	Se dissoudre	Komelama
Composé chimique	Etongami na kemi	Solution	Lisangana
Neutralisation	Bosukisani	Solvant	Emela
Neutron	Netrón	Substance chimique	Ezala ya kemi
Réactif	Ebóngolana	Réducteur	Etíka
Réaction chimique	Bobóngolani na kemi	Tableau périodique des éléments chimiques	Etanda ebandelaka ya bibuki ya kemi

5.3. Generalization of our method

We used the target language, Lingála, as our working language. This approach allowed us to incorporate the cultural aspect, which is not always easy to identify in the context of sciences like chemistry, where a universal frame of reference is established. Working directly in Lingála placed us in the Congolese cultural vision.

Terminologists can use the method described above for coining scientific terms in any scientific or technological field. He/she must keep in mind that working in his/her African language, he/she is not making a translation, but a course or a book in that language. If he/she does not immediately succeed in coining African terms, he/she can borrow them from the European language used as the official language in his/her country, while bearing in mind that the terminology coining work is an on-going pursuit.

6. Approach for the dissemination of chemistry terms in Lingála

We have described the techniques that have allowed us to coin specialised terms for chemistry in Lingála. As it is in our case an intentional process and not the result of natural language practices, as such it requires the implementation of strategies for dissemination. Our next step, therefore, was to

submit these terms to native speakers who are also experts in the field, namely, chemistry teachers from the city of Kinshasa, for their approval and possibly for adoption.

In this section, we describe the approach we followed to disseminate the terminology among both teachers and students in secondary schools in Kinshasa.

6.1. *The attitudes of Principals of schools*

We sent six investigators with the periodic table as a commercial product (Sene Mongaba 2009) to 102 secondary schools in Kinshasa. The fieldwork took place from 05 September to 21 December 2009. This survey was designed to observe whether the presence of Lingála in the periodic table could be an obstacle in the acceptance of our proposed periodic table as a school text.

6.1.1. *Principle of observations*

The investigators we sent to the targeted schools were neither chemists, nor professionals in education. Their role was limited to proposing the periodic table to school officials as school supplies for sale to students. We did not take into account data on sales, since this was not part of our research objective. We did not instruct investigators to ask questions of school officials. The six investigators proceeded simply by observation, as we did not want to influence or direct answers.

We directed them to carefully observe the reactions of the recipients by focusing on the following 5 points for their observation, and report to us:

- (a) Who received you at the school?
- (b) Was the person surprised to see Lingála in the periodic table?
- (c) Did they take the table or not?
- (d) Why did they refuse?
- (e) What did those who accepted say?

6.1.2. *The results of survey*

When each investigator returned, we asked him the following questions:

- (a) Who received you in school? (*Náni ayambáki yó na ekól?*)

To fully appreciate the answers to this and other questions, it is noteworthy to point out here that schools are organized differently. In general, when the investigator arrived at a school, he addressed himself to the reception. He was then introduced to the principal or to the chemistry teacher. Out of the 102 schools surveyed, in 81 schools the investigator was sent to the principal and in 21 schools to the chemistry teacher directly.

- (b) Was the person surprised to see Lingála in the periodic table? (*Akámwáki tángo amónáki Lingála na tableau périodique?*)

In all 102 schools, the principal or the chemistry teacher was surprised to see Lingála in the periodic table. Only teachers who had participated in the conference in November 2008 were not surprised, since they were already aware of its existence.

- (c) Did they take the table or not? (*Bazwí tableau périodique tó bazwí té?*)

Out of the 81 schools where principals received the investigator, 15 schools rejected the periodic table. All 21 schools where chemistry teachers received the investigator agreed to take it.

- (d) Why did they refuse? (*Babóyi pó na níni?*)

Out of the 15 schools which rejected the periodic table, 6 schools did so because of the presence of Lingála. The principals indicated that their schools were in neighbourhoods where parents would not accept seeing their children with a school text in Lingála. All of these were schools situated in affluent areas and their reputation was the key factor. Two other schools declined to take the table because their principals were not used to selling products to students; four others deemed the table not to be in

accordance with national curricula and three other schools did not take it because one had already been sold to students.

(e) What did those who accepted say? (*Baóyo bandimáki bazaláki koloba nini?*)

Almost all of those who accepted the proposed table first indicated that they appreciated the presentation in it and the fact that it was up-to-date (116 items instead of 109). Even the schools that did not take the periodic table because of Lingála indicated that they thought it was a good innovation. All these findings are summarized in **Table 3** below.

Table 3. The reception of periodic table at 102 secondary schools in Kinshasa

SCHOOLS	TOTAL NUMBER	%
Schools where the chemistry teacher received an investigator		
Number of schools that have accepted	21	100%
Number of schools that have refused	0	0%
Total	21	100%
Schools where the Principal received an investigator		
Number of schools that have accepted	66	81%
Number of schools that have refused	15	19%
Total	81	100%
Number of schools that have accepted	87	85%
Number of schools that have refused	15	15%
Total of schools	102	100%

We believe that these results are highly informative and positively revealing in light of the established tendency, in fact ideology, on the putative inability of African languages to accommodate scientific and technical communication.

6.2. *The attitudes of chemistry teachers and their students*

On 28 August 2010, just before the opening of the school year (2010-2011), we met with 42 secondary school chemistry teachers during a conference and we recorded their feedback on the proposed period table. Our goal was to observe the reactions of such teachers and their students on the bilingual periodic table that we were proposing.

As the use of Lingála is officially banned in several schools, we did not collect the views of pupils directly, because it would have contravened the schools' instructions. So we analyzed observations made by teachers who had, in this case, acted as investigators for the research project.

6.2.1. *The conference*

At the conference, we proceeded by asking questions and recording the teachers' answers. We introduced the debate as follows:

(a) What was your reaction when you saw a periodic table in Lingála? (*Tángo omónáki tableau périodique na Lingála, ozwéláki yangó ndéngé nini?*) We let the teacher talk.

(b) If he did not talk about the reaction of the students, we followed up: And the students? (*Ebóngó bána ya classe?*)

These open questions were designed to allow the teachers to develop arguments and a description in connection with the city's sociolinguistic and didactic considerations. The conference was recorded by voice recorder and later transcribed for processing.

6.2.2. Results

The results we obtained were very conclusive: The students were willing to learn in Lingála facile. Some of them even commented that, when they read the chemical elements terms in Lingála, they had at last realized atoms were real, but not fictitious objects. We never expected, at any time during our preparatory work, such an observation. This observation by students demonstrates that teaching in the mother tongue is crucial in the appropriation of knowledge. Chemistry is a new subject for pupils who start the third year of secondary school, and it is taught in French. If pupils have a poor command of French, teaching them about the world of infinitely small elements can even lead them to think that such elements are fictional, not real science.

‘Why wait so long to sell us a periodic table in Lingála facile?’ This question raised by most students (4th, 5th and 6th grades) reinforces, on one hand, our belief that students face problems in learning academic subjects in a foreign language. On the other hand, having seen a school text written in Lingála equally reinforced the prestige of their own language in their eyes. They could speak about chemistry in Lingála without feeling uncomfortable or awkward. Unfortunately, such courses are still taught in French.

6.3. Analysis

Contrary to our expectations, the periodic table was accepted more in relation to its content and presentation than to the languages used. Indeed, most schools accepted it because of its presentation and scientific content. The presence of Lingála was much appreciated as an innovation, but Lingála was not necessarily a selling point. However, principals of schools and school teachers still appreciated the initiative to use Lingála for the periodic table as an approach that could improve understanding by chemistry students. Schools that rejected it were keen to keep their reputation among parents who are, reportedly, very much opposed to the use of the Lingála as a language of instruction.

During the conference, my interlocutors stressed the fact that teachers did not have a sufficient knowledge of Lingála, due to the fact that most teachers do not study Lingála at school. Instead, they learn the language, like their pupils, on the street as it is spoken in Kinshasa. The teachers stressed the difficulty they would face in translating their course into Lingála. Through the bilingual French-Lingála periodic table, teachers discovered at the same time as students the chemical nomenclature in Lingála. This implied that teachers did not yet know that nomenclature either. Some teachers admitted that they had some difficulty in answering students’ questions concerning nomenclature in Lingála. This demonstrates that while teaching in Lingála may be effective in educational terms, there are some adjustments to be made in the curriculum, including strengthening the teacher’s proficiency in Lingála.

7. Conclusion

This paper has shown the importance of taking into account sociolinguistic realities (Diki-Kidiri 2008: 113) in data collection and in the dissemination of terms proposed to end users. The dissemination of our findings is made easier by the existing practice in the Kinshasa school system of using Lingála to explain chemistry to students. Besides the sociolinguistic aspect, we also sought to identify a terminological approach in the teachers’ responses. This is far from being achieved, especially since the teachers were more interested in teaching approaches than in coining terms. They still appreciated the effort in terminology development and when they were not satisfied with the outcome, they never failed to raise the point. The fact that at the moment teachers use Lingála to explain chemistry and the terminology work is not yet finished leads us to conclude that the coining of terminology in the language is important but not a precondition to the use of African languages as media of instruction.

The volume of work carried out in the coinage of chemical terms in Lingála has allowed us to start producing documents written in Lingála for teaching chemistry in DRC. That demonstrates the

feasibility of empowering African languages with scientific terminology. It also proves that terminology work plays an important role in reinforcing positive attitudes towards the use of African languages in the school system. The results obtained advocate strongly for the pursuit of this type of coinage efforts not only in teaching chemistry and in Lingála, but also in other sciences and other African languages.

We believe that by applying the methodology developed here, policy makers and authors of textbooks can be involved successfully in this endeavour to improve the process of appropriation of knowledge among African students.

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