The contribution of ICT in teaching and learning Tone of Tanzanian Bantu languages

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Abstract

This paper was intended to discuss the contribution of Information Communication Technology (ICT) in teaching and learning tone of a given language. The paper urges that apart from depending only traditional education technology and methodology in learning and teaching, ICT can contribute successfully in teaching and learning tone. In traditional perspectives, it is believed that teaching and learning of subject matters is very much related and necessitated by offering training on formal settings which involve classroom interaction an organized classroom with hardcopy books and other related matters. With the development of ICT, and the rise of network, the correspondence and interaction through networking has expanded globally. One of the tools used in teaching and learning of Tone is ICT, specifically Computer. The theoretical framework adopted in this paper are Classic learning theories which include behaviorism (Skinner, 1953), Cognitivism (Gagne, 1984) (Akinsanmi, 2008). Qualitative approach was employed to involve the researcher's interpretation of linguistic narrative data which were obtained from the documentary reviews and focus group discussions done by respondents both students and instructors on tone class by giving them freedom of expression on how ICT was facilitated them tone learning. The study was carried out in two programes in MA. Linguistics class, in one university. This study used three methods such as focus group discussion, *interview and documentary review.*The findings of the study were: (i) that ICT facilitates teaching of tone through application of symbols and equations that couldn't be possible or difficult in using free hand drawings, (ii) easy manipulation of sounds and tone marking strategies of which the mechanical listening of sounds through ear that may miss- lead tone interpretation has facilitated the accuracy tone analysis. The conclusions drawn from this study were that the Institutions which are involved in teaching tonology can get use of ICT technology in a very formal way thus contributing to high level of mastering the of subject matter with a minimum time waste. The paper recommends that both learners and instructors should be ICT illiterate and get use of it as through establishing computer laboratory to enable students to have an access to computer facilities, thus contributing to sustainable development in terms of human resource utilization and innovation.

Key words: ICT**,** network, social media, language, teaching, tonology, Bantu

Introduction

This paper assesses the contribution of ICT in facilitating teaching and learning of tone, one of aspects of suprasegmentals phonology. Before we proceed to our discussion, it's important to explain, briefly, ICT and tone. Technology refers to the application of scientific knowledge to the practical aims of human life or as it is sometimes phrased to the change and manipulation of the human. The first attempts to integrate personal computers into the sphere of language teaching were taken in the late 1980's which opens up thousands of possibilities to revise and improve teaching including teaching tone (Chernov, 2014). The adoption of new science and technologies has led to significant changes in teaching and learning of tones of a given language (Nurutdinovaa et al, 2016). The use of ICT transforms traditional teaching and assists the

adaptation of new curricula and new courses in existing applications (Nurutdinovaa et al, 2016). In any classroom, ICT is of a great value since it is an aid to comprehension; that the ICT promotes learners' response to literary texts, it promotes language awareness, and it increases learners' motivation (Zainal, 2012). On the other hand Tone in linguistics refers to pitch variation that affect the meaning of a word (Hyman, 2000). Hyman (2014) describes tone as a linguistic term for a phonological category distinguishing two utterances. For instance, in Makhuwa language the word /*ukwa*/ can mean to cease if the tones on each syllable are Low, but it may mean to come if the syllable has a High tone on the infinitive prefix /u/ while the second syllable known as the final syllable has a Low tone. Therefore tone is an important feature of African tone languages because meaning and production of the syllables, words, phrases and sentences are severely guided by the tonal patterns of a language. Tone can also contributes to both lexical and grammatical contrasts. Therefore, any lexical or grammatical construction in African tone which is not properly tone-marked automatically may mislead the tonal analysis.

Also, it can be urged that the study of tone is so complicated even to the native speakers of a given language. This necessitates the need to teach and study tone using modern strategies. This paper intended to explore the contribution of ICT in teaching tone of Bantu languages in Tanzania. The study will be significant in the field of phonology as it will insist and promote the necessity of using new technological strategies of learning tone instead of depending only on traditional approaches and methodologies that depended only a mere traditional way of tone identification This will be the basis to a successful teaching and learning of tone with high performance.

Literature Review

The assessment on contribution of ICT in facilitating teaching and learning in education perspectives, has been discussed in a number of academic work. In this paper, we will briefly review works that seems close to our topic of investigation. Most of the studies urges challenges teaching and learning prior to ICT innovation.

Orie (2006) found that there were several challenges in learning and teaching tone through traditional approach such as problem of tone identification, time wastage, misleading in tonal analysis and even problems that relate with tonal convections that are used in tone marking. Drawing examples from Yoruba, one of the Bantu language, Orie reports that typically, Yoruba tone is taught through an Intuitive-imitative approach. This approach assumes that a student's ability to listen to and imitate the rhythms and sounds of the target language will lead to the development of pronunciation without the intervention of any explicit information. This approach crucially uses repeated pronunciation drills, which are supposed to enhance word and tone memorization. The problem with this approach is that it focuses on lexical tones. Post-lexical or syntactic tones, on the other hand, are rarely taught. The approach used sounds simple and logical but in general, it is not very effective. Due to that ineffectiveness and even frustrating the learner, the use of ICT has helped much in teaching and learning tone in Bantu language.

Tsai (2012) on the other hand asserts that learning the tones of Mandarin Chinese usually presents challenges to new students. Practice is the key to developing the areas of the brain that are needed to process tones. The listen-and-repeat drills that have traditionally been used extensively for teaching Bantu tone are ideal for the study, but using traditional mechanical approach creates boring and it may mislead the whole tonal analysis.

Marlo (2011) on his discussion on Teaching and learning tone of a given language indicated difficulties that learners are likely to face when interpreting pitches with traditional approach because when listening to a speaker because what is heard in fact are not tones rather we hear pitches. For that reason there is a need to employ ITC in teaching and learning for accuracy as much as possible. The same observation was noted by Hyman (2014) who suggested a need for ICT application in marking pitch on every vowel as well as on every syllabic sonorant consonant because there is no universally accepted phonetic transcription for pitch. This requires hearing from native speakers of the language, but the problem comes on the procedures of recognizing the right pitch contours and other tonal related aspects. Traditionally, teachers and learners have to hear from the native speakers through hears direct from the speaker. In other words, traditionally, tone is realized by assuming pitch contours something which can lead to difficultness to differentiate the high pitch (H) or low pitch (L) but labels such as "falling" or "rising" are often not sufficient to describe the tones in a language (Schellenberg, 2013). This challenge marks much more difficult to teach and learn tone without the application of ICT Innovation (Holton, 2003). In this context, the application of ICT is necessary in teaching and learning of tones in very accuracy manner.

In a tonal discipline, especially after reaching sounds of a given language, teachers and learners are required to analyze tone in a given language. Whatever the approaches of analysis, traditionally, symbols and presentation of the analyzed tone have to be done using writing boards, papers or pads, chalks, pens, mark pens or typewriters. What complications that may be associated to tone learning and teaching on traditional orientations? Generally tone marking done the intuition approach in data analyzing can cause incorrect tone understanding because this approach is based on marking tone while a person is pronouncing a word. If person marking tones do not understand it may lead to unacceptable tone in specific language. For instance a linguist can mark a High tone in the place of Low tone because of improper understanding of tone but if this is done by recording the word by the PRAAT, may lead into consistency and soundness of such a word.

Kaoo (2004) indicated a challenge when marking tone in words without the use of technological devices like PRAAT, computer software used to analyze pitch sounds of languages in linguistics. Through the use of intuition approach alone in tone marking may lead to the failure of identifying proper tonal patterns of a language, such tonal patterns can be High tone (H), Low tone (L), Downstepped (D) depending how the behavior of specific language dictates.. For instance Ruhyoza, the Haya dialect consists of four tone patterns in Ruhyoza Nouns as elaborated by Kaoo (2014) in the following illustration:.

(1) a) e ka   é ka   "a family"

     b) e nyi ndo   é nyi ndo   "a nose"

     c) o mu li ro   ó mu lí ro   "fire"

Muzale (2006) observed that, marking tone without technological instruments like PRAAT, can lead to wastage of time hence the researcher can waste his or her time in marking tones and because using the intuition approach in data analysis is like predicting tone marking on the certain leads one to remarking tones several times accompanied by deletion which result into time consuming.

(2) a) úkwa   "to die"
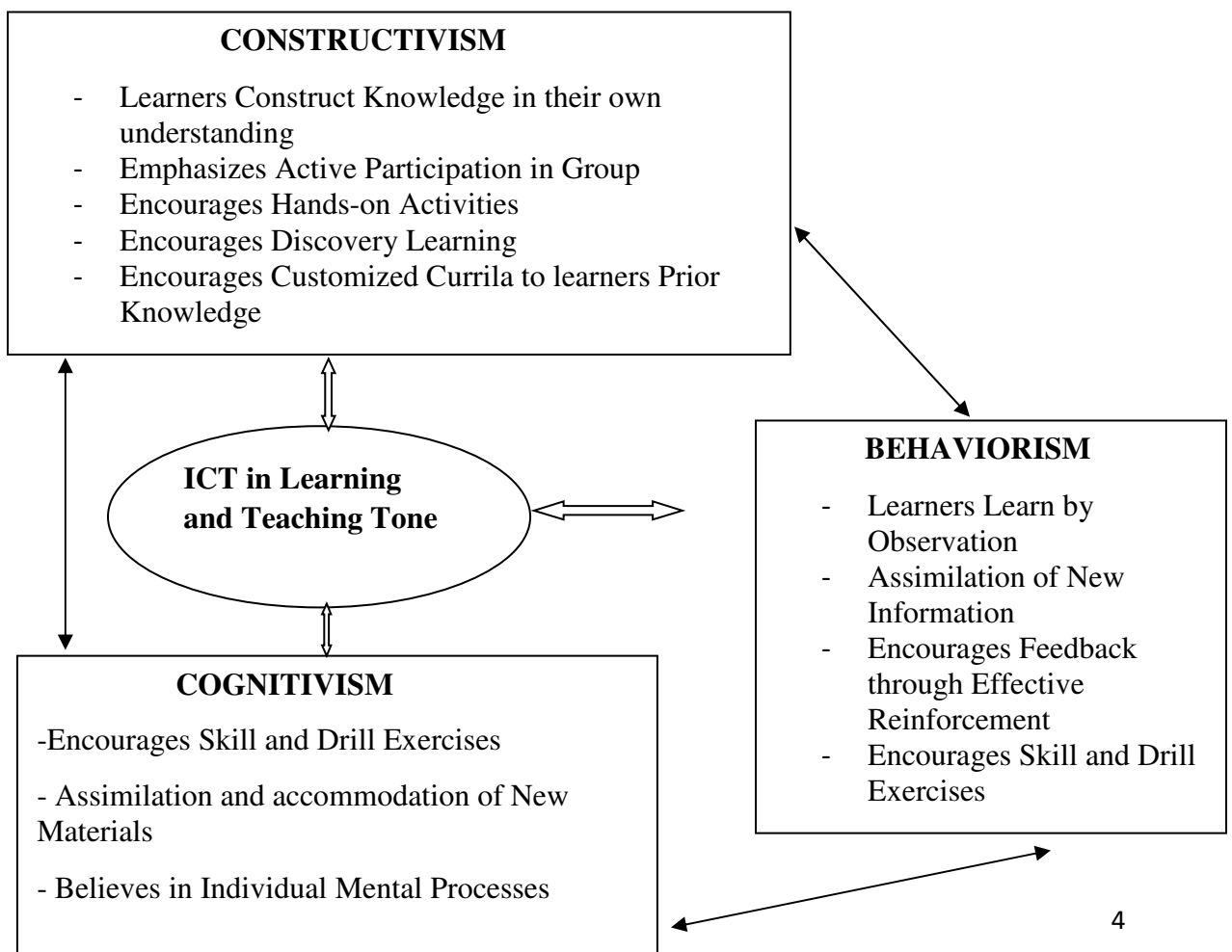
    b) úlya   "to eat"

In this marking in (2) ICT can clearly show the accuracy the status of tone.

The reviewed literatures indicates the problems that can be associated with the traditional approach of teaching and learning tone of any given language. Also the reviewed literatures, shows that little has been done on the contribution of ICT in teaching and learning tonology of Bantu languages. Therefore, this paper focused on the contribution of ICT in teaching and learning tone of Bantu languages of Tanzania.

Theoretical framework

The theoretical framework adopted in this paper are Classic learning theories which include behaviorism (Skinner, 1953) which believe that learners learn by observation, assimilation of new information, drill and exercise, Cognitivism (Gagne, 1984) which encourages skills and drill exercise and accommodation of new materials and Constructivism (Akinsanmi, 2008) which emphasizes on learners construct knowledge on their own understanding and active participation in groups. The basic principles of these theories are summarized in figure 1 below. As these learning theories are not new, a reader is advised to consult the relevant literatures for more discussion.

Figure 1: A Summarized Learning Theories on ICT and Tone

CONSTRUCTIVISM

- Learners Construct Knowledge in their own understanding
- Emphasizes Active Participation in Group
- Encourages Hands-on Activities
- Encourages Discovery Learning
- Encourages Customized Currila to learners Prior Knowledge

ICT in Learning and Teaching Tone

BEHAVIORISM

- Learners Learn by Observation
- Assimilation of New Information
- Encourages Feedback through Effective Reinforcement
- Encourages Skill and Drill Exercises

COGNITIVISM

-Encourages Skill and Drill Exercises

- Assimilation and accommodation of New Materials

- Believes in Individual Mental Processes

4

Source: **Kasocsa and Koppony (2004)**

Methodology

The stud has two types of information required. The first information was that required to observe the challenges of teaching and learning tone to a given language and the second one was the information that wanted to illustrate the contribution of ICT in facilitating learning and teaching tones. For the first aspect the study was carried out in Makhuwa speaking area in Masasi district at Mtwara whereby Makhuwa language is spoken. The researcher collected data in only one village known as Mikangaula. The area was purposely chosen to enable the researcher to get the required data hence the Makhuwa language is well spoken over the area and there is no strong influence of Kiswahili toward the Makhuwa. Also the researcher was well familiar with the place; therefore, it simplified the process of collecting data. The researcher purposely sampled the informants, the study required speakers who were pure speakers of the Makhuwa and fluently in Makhuwa. Then I recorded myself articulating the items which later on were then transferred into a computer system for speech synthesis or annotation using software PRAAT. The instruments used for this work were computer, earphone, microphone, and software PRAAT.

In the second aspect, the information were gathered during teaching and learning tone in one program which I taught tone, at Postgraduate program. The programs are MA linguistics from University of Dar es Salaam. Through Focus Group Discussion: The researcher employed this method by employing (43) participant in group discussion from (23 MA linguistics students); During the discussions in the field time, nine (9) participants were requested to articulate words whereby the first group of three (3) participants were requested to pronounce the group of one hundred (100) words in simple infinitive, the second group of three (3) informants were requested to articulate another one hundred (100) words with Makhuwa complex infinitives and finally the other group of three participants pronounced the final group of one hundred (100) words with Makhuwa simple and complex infinitives.

Data Recording

The researcher prepared three (3) participants for the recording process whereby the first two informants were recorded while articulating the first category of infinitive verbs which is the simple infinitive stems with one to seven syllables and the second two informants articulated the complex infinitive stems with one to seven. This tool was used in data collection due to the nature of the study which based on sound identification.

The researcher used the Adobe Audition, computer software to mark tone and analyse pitch sounds.

Data Analysis Strategies: Data collected were analysed as follows, the information obtained from the corpus of Makhuwa words were compiled and arranged according to the number of syllables starting with those consisting one syllable to those infinitives having more than one syllable in the data base. This enabled the researcher to realise the tonal patterns which were discussed considering the number of syllable of the verb stem they have.

Results and Discussion

ICT facilitates accuracy in tone marking

20 participants out of 23 indicated that the application of ICT in tone marking is effective in productions, acquisition, storage and retrieval of the recorded data for use. Also the tonal information that has achieved through ICT can properly data stored and easily be retrieved and used for future research. The following illustration indicates waves in tonal identification for the infinitive /úlya/ which can be easily identified through ICT instead of a mere listening from the ear.
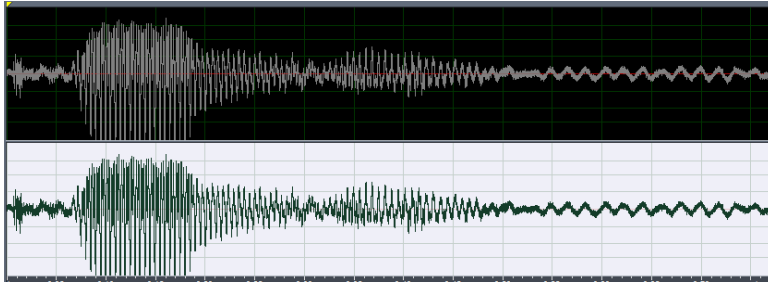
Figure (1): úlya

Figure (1) shows that words under simple infinitive stems in a wave forms whereby the strong wave presents the High tone /ú/ while the weak one presents the Low tone/lya/.

Therefore, a learner of tone can easily identify tone through the use technological devices like PRAAT which is computer software used to analyze pitch sounds to make effective use of the necessary technological technique of tone marking aid specifically for the analysis of tone in the era of technological developments.

ICT is Efficient in Tonal category Identification

In tonology, there is a great change of teaching and learning tone due to technology hence includes the use of PRAAT, computer software for the annotation of the pitch form which presents the number of tones a language consists, spectrographic reading can show the type of tonal patterns such as High tone (H), Low tone (L), Downstepped (D) in some languages, Low-High tone (LH) also known as Rising tone and High- Low tone (LH) also known as Falling tone. Through the use of technological devices, it is easier to identify the tonal patterns of a language rather than guessing. The participants also shows the effectiveness of tone marking on each syllable that a word consists, since tone is an abstract phenomenon, it is more practicable and easy to identify and appreciate the relative pitches on segments when displayed on a computer.

The distinction between each tone level is measured by the timing of the radiated frequency of the pitches on the right edge of the spectrograph. Therefore, this reveals the efficiency of tonal identification hence tone marking is more practicable and easy to be identified and appreciate the relative pitches on segments.

ICT Leads to Correct Pronunciation of tones

Technological tools like PRAAT computer software, displays the actual pronunciation of the word, tone marks have to be clearly written because the structure of the language requires it for accurate articulation which result into meaning of words, phrases and sentence. In order to mark tone correctly in a language, one should acquire the computer knowledge so as to make effective the necessary technological aids like PRAAT computer software

ICT enhances a feasibility study of the different patterns of tone

The use of ICT in the study of tone has led to the great changes specifically the feasibility study of different patterns of tone, it is now easy to identify the tonal patterns a language consists through the use of spectrographic reading which shows the type of tonal patterns such as High tone (H), Low tone (L), Low-High tone (LH) also known as Rising tone and High- Low tone (LH) also known as Falling tone. Consider the example below from the Haya language cited by Muzale (2006) who discusses the two types of tonal patterns in Haya language and these are High tone (H) and the Low tone (L).

 2. a) kúhwa   H   'to give'

   b) kuhwa   L   'to cease'

   c) kusinga   L   'to rub'

   d) kusínga   H   'to win'

In 2 display the tonal patterns of a Haya language which are the High and Low tones that are marked on such words.

These tones can be well marked by the use of PRAAT computer software used to analyze pitch sounds of /ukwa/ which consists of a High tone whereby the figure contains wave forms and each column contains the different sound of the segments and The distinction between each tone level is measured by the timing of the radiated frequency of the pitches on the right edge of the spectrograph.
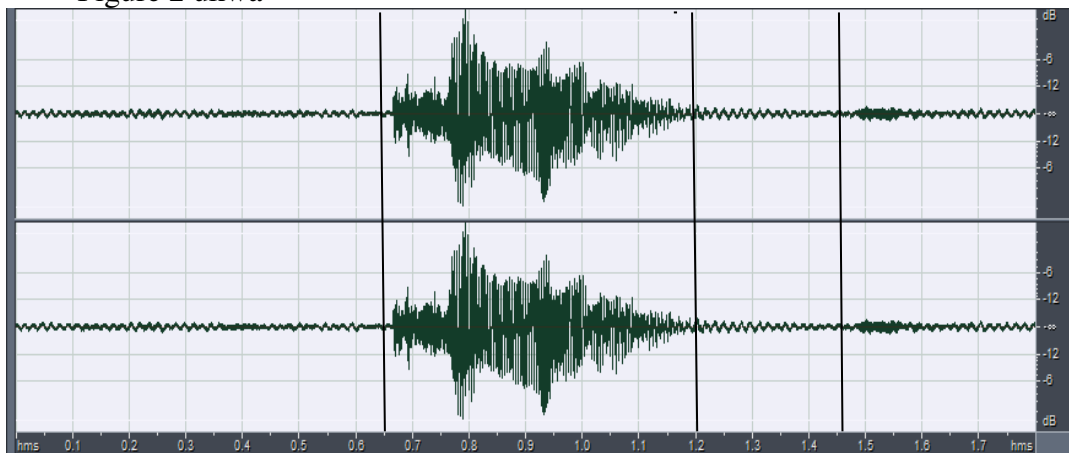
Figure 2 ukwá

Figure (2) shows an acoustic analysis of High tone; /*ukwa*/ 'to give' H   L. In this figure, wave forms, the strong wave indicates the High tone and each column contains the different sound of the segments and the distinction between each tone level is measured by the timing of the radiated frequency of the pitches. The application of PRAAT tool enhances the study of the tonal patterns of words as they are displayed on the spectrographic.

ICT facilitated learning of complicated tone system
In traditional education technology, it was difficult to identify tone of extreme complicated system of which a language may have low tone with super low, high tone with super high even a mid tone. In a sample, when students were given the following words in Kikamba and asked to articulate and one has to listen orally"

3.
   a) e.i.à   (Low)   lake
   b) è.i.o   (Low)   banana
   c) ndá.a   (High) louse
   d) è.i.a   (Low)   weed
   e) kóya   (High) to eat
   f) kokonà (Low) to hit (infinitive)

Source: Roberts-Kohno, R.R (2005)

The response on these tone feature didn't show any complicated tone forms apart of just L (low) and H (high). But when the same words were recorded using the Pratta and subjected to ICT tools, it shows the complicated tone system of which now it has the following tone pattern:

4.
   a) ë.i.a   (Super Low)   lake
   b) ë.i.o   (Super Low)   banana
   c) nda´´.a (Super High)   louse
   d) e.i.ä   (Super Low)   weed
   e) ko´´ya   (Super High)   to eat
   f) kokonä   (Super Low) to hit (infinitive)

   Roberts-Kohno, R.R (2005)

In these paradigms, the SH tone is interesting because it is the combination of the features of the High tone and the SL tone

In Bantu languages, there a variety of context of which a mora is followed by mora which bears a high tone in the same syllable. Essentially, this would result in a syllable with a rising tone. In tautosyllabic rising tones are prohibited in Makhuwa. A principal of Rising tone neutralization is active which causes such tone sequence to be resolved into level tones. Thus whenever a mora is followed by a mora which bears a high tone, the tonal node of the second mora in the syllable spread leftward, creating a level tone.

ICT enhances precision on the exact height of each tone

Technology provides the correctness and visible height of each tone, the analysis done by the technological instruments in linguistics specifically in tone marking shows the exactly height of each tone hence the distinction between each tone level is measured by the timing of the radiated frequency of the pitches and these tones are indicate in the wave forms whereby the wave which are strong indicates the High tones of the language and those which are weak in form signify the Low tones of the language. The complex infinitive stems with six syllables present the behaviuor of shifting and spreading of tone whereby the High tone of the first syllable of the stem is shifted to the penultimate syllable of the stem then the High tone of the object marker spreads three more syllables on the right side of the word before reaching the penultimate syllable, it is blocked by one Low tone followed by the High tone on the penultimate syllable and finally the Low tone on the final syllable of a word as in (3):

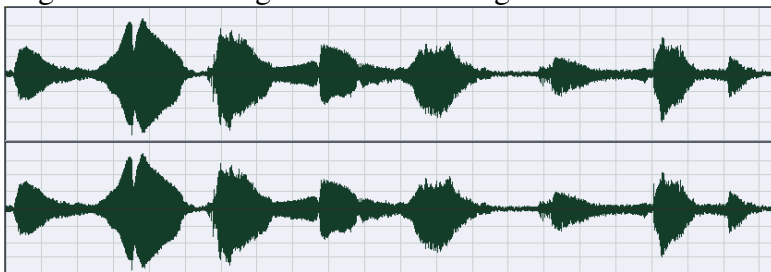Figure 3: umútélángánilána   "to fight for him/her for each other"

Figure (3) demonstrates the pitch sounds of the complex infinitive stems in category six which consist of Low tone followed by four High tones then Low tone followed by the High tone and lastly the Low tone as verified in figure (3) whereby the strong waves as usual present the High tones while the weak ones for the Low tones.


ICT facilitates the Storage of tonal information and retrieval

The application of ICT in tone analysis is effective in facilitating the storage of the tonal information and easily retrieval of the recorded tonal data that can be used for further researches. This is an advantage because data are kept safely in softcopies for future use rather than being kept in hardcopies where are easily to be lost, they can be stored in e-mails and websites. Apart from storage for retrieval, also the use of computer to analyze data provides the foundation for yielding fast and quick speed during the process of marking tone.

ICT enforces criteria for being consistency

Technological tools like PRAAT computer software used to analyze pitch sounds of a language implements the reasons for the analysis to be uniform without distinctions and complete. Technology also avoids under generalization and overgeneralization of the process of data analysis specifically in tone marking. Therefore, the use of technological devices like PRAAT software for the annotation of the pitch sound shows the number of tones a language consists, spectrographic reading can show the type of tonal a language consists since tone is an abstract phenomenon, it is more practicable and easy to identify and appreciate the relative pitches on
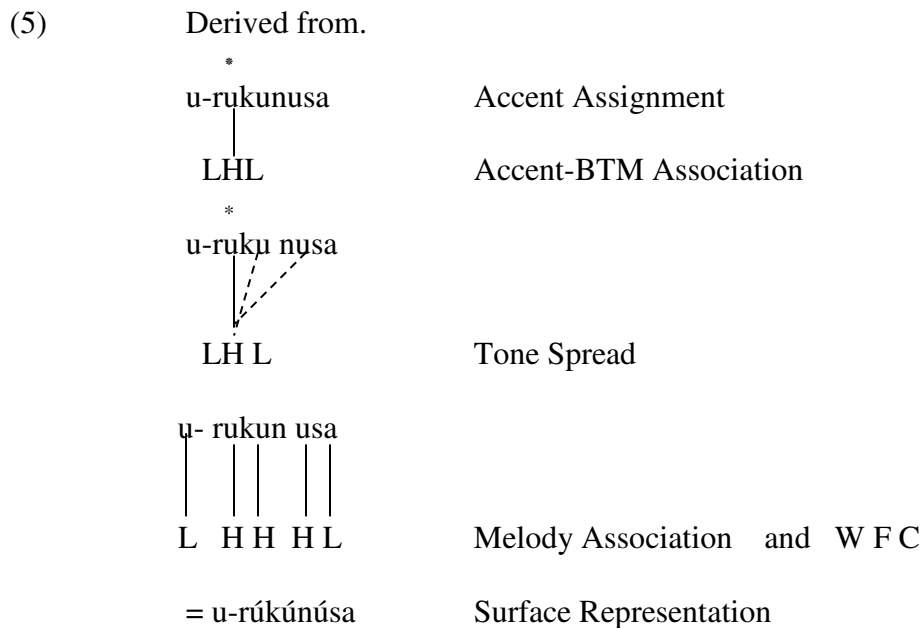
Figure (4) : uthékéla
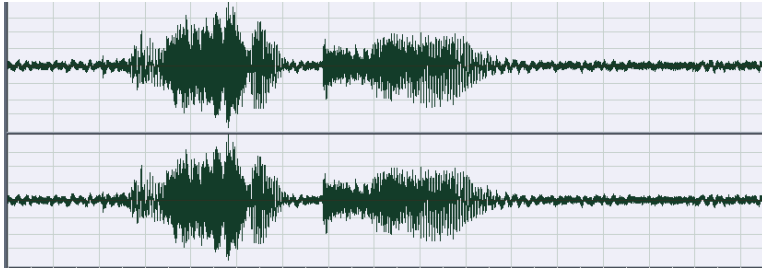
In figure (4) illustrates simple infinitive stems in category three which consist of Low tone followed by two High tones and lastly the Low tone as indicated in figure (4) in wave forms whereby the sting wave stands for the High tone while the weak ones for the Low tones which are the infinitive prefix and the final syllable of the stem the High tones on the first syllable of the stem and on the penultimate syllable.

After examining the behaviour of complex infinitive stems with five syllables and rules that govern the assignment of tone in complex infinitive stems with five syllables, the following is the figure proving the pitch sounds of words under this category of complex infinitive stems in category five as done by an Adobe Audition.

ICT can facilitate tonal derivation
Tonal rules that govern an assignment of tone in complex infinitive stems with seven syllables are established by using the derivations and each rule at each stage is declared. Consider the derivation in (5) below: In (5) shows the extent of ICT can easily resolve the complicated tonal rules in *u rú kú nú sa*

(5)   Derived from.

                    *
        u-rukunusa   Accent Assignment
                |
          LHL   Accent-BTM Association
            *
        u-ruku nusa
                |
          LH L   Tone Spread

        u- rukun usa
        | | | | | |

        L H H H L   Melody Association   and   W F C

        = u-rúkúnúsa   Surface Representation

The derivation (5) the accent is assigned on the object marker and on the first syllable of the stem. The High tone of the first syllable of the stem shifts to the penultimate syllable because the accent on the first syllable of the stem is inferior to that of the object marker, which means the

accent on the object marker is superior. Then the High tone of the object marker spreads three more syllables of the stem to the right side of the word then blocked by the third and fourth syllables of the stem which are Low toned.

Conclusion

This paper has discussed the advantage of using microcomputers in teaching and learning tone and intonation. Specifically, it has been demonstrated that the computer application has the advantage in making immediate and unlimited playback capacity compared to cassette or reel-to-reel tapes which must be rewound for each playback (Chun, 1989).

ICT has provided potentials for enabling teaching pedagogies and methods in tone teaching and learning because it enhances language learning is cooperative, authentic, and meaningful (Kumar & Tammelin, 2008). Students can listen, speak, read, write, and otherwise respond by using ICT tools in support of their language learning tasks therefore, simplifies teaching for language teachers so that they can the different needs of learners. Thus, it can be argued that ICT can transform a traditional lecture/drill-based CFL classroom into a more interactive and dynamic learning environment (Lin et al, 2014).

It has been observed in the cause of discussion that the instructor who teach tone rules through h Computer-Assisted Devices can perform in very accuracy manner as compared to the traditional ways of which a mere typewriters were employed. Individual sounds, word stress and basic intonation cab best be noted through computer application thus serving time and making learning accuracy.

Recommendation

Despite the advantages of using computers in teaching and learning of Bantu tone but the challenges are high which are attributed by the lack of many instructors to be computer illiterate. There is a concern of institutional may address on the problem of computer illiterates which can call the individual institutors and learners to make more efforts to mastery of computer applications. Few teachers use computers for teaching and learning purposes while the majority of them use computers for administrative purposes and personal use (Kafyulilo & Keengwe, 2013). This can also be realized in teaching and learning of tone. In spite of the technological advancement in education, phonology teachers and learners are still using traditional methods of teaching and learning tone thus there is a need of rethinking on the role of traditional tone teaching and learning and embarking fully to ICT application on tone teaching and learning.

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