CAMTS: Computer Aided Multidialectal Teaching System

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Abstract—**This research aimed at the development of computer aided multidialectal teaching system (CAMTS) that can be adopted and used as teaching tool in schools. We focused on simple arithmetic for nursery school pupils as our test case. The age group considered is 3 years to 5 years old. Our objective is the provision of a software tool that enables nursery school pupils learn and interact using three dialects from three Nigerian tribes (i.e. Igbo, Hausa, Yoruba) and one dialect in Togolese tribe (i.e. Ewe). The multidialectal component of the system gives room for easy teaching by the teachers and easy learning by the pupils in their native dialects. Moreover, both teachers and pupils have opportunity to learn another dialect aside their own dialects. CAMTS is flexible and can be scaled up to accommodate other dialects such that it can be adapted to other environments aside Nigeria and Togo.**

Keywords-Multidialectal, Teaching, Pupils, Nursery school, Computer aided system, Education.

I. INTRODUCTION

Teaching aids are tools that complement the efforts of classroom teachers and used to assist students to learn quickly with ease. A teaching aid can be chalkboard, lesson notes, counting sticks, toys, ruler, computer based teaching applications etc. Students have the tendency to learns in a different way and thus teachers rely on teaching tools to explain concepts to students with a wide variety of learning needs. Teaching aids are crucial for educators as they are means of relaying instruction to all types of learners and convey information or ideas in the classroom. Teaching techniques such as: *Lecture Method, Tutorial Method, Case Based Teaching, Project Based teaching, Practical Teaching;* are the methods the teachers can use to instruct or teach the students. A well performing classroom is a function of good teaching strategies complemented with the appropriate teaching tools that align with the interest of the students. Most teaching aids are visual in nature. *Blackboards and whiteboards, posters, calendars, charts, drawings, and overhead projectors* are all examples of visual teaching aids.

This class of aid is important because some people learn best through use of visual items. Another class of teaching aids is aurally-based such as: *recordings of spoken broadcasts and songs*. Audio-visual teaching aids include *film projectors, videocassettes, DVDs, and movies on the Web*. These teaching tools complement the efforts of the teachers and thus are not replacement for the teachers.

The earliest teaching aid is the *globe* and it originated in ancient Greece. It has been used as an educational tool since 150 B.C. The *hornbook* was another early teaching aid used in classrooms starting in the mid-1400's. The *hornbook* is a piece of paper containing the alphabet that was mounted on wood, bone, and in some cases leather. The *chalkboard* was patented in 1923 by Samuel Read Hall, and replaced the *hornbook* in classrooms around the world [26][27]. Since the dawn of the technology age, computers have proved to be one of the best multifaceted teaching aids available [18][19]. With digital tools, teachers are now able to quickly and accurately enlarge any physical visual aid, create and edit informational slides, and can ultimately provide their students with information in a faster and more comprehensive way. Computers provide an interactive educational experience that engages learners and makes the task of preparing lesson materials less time-consuming for teachers.Though aids are crucial to successful teaching, they are not a replacement for quality teaching strategies. Instead of relying upon teaching aids to do the instruction, these tools are used as supplemental resources for educators. Many students cannot perform to their fullest potential without the use of teaching aids, but no student can produce their best work without a skilled teacher behind them [32].

A multilingual teaching aid will be able to reach out to the diversity of people who are willing to learn but have language as a barrier. For instance if one tries to teach a basic Mathematics lesson to a nine-year-old Nigerian child in French: it is clear that this is not an appropriate language to teach Mathematics. But this is the situation in which millions

of children worldwide find themselves. The German and Swedish governments recognise the need for bilingual education, but very little investment has been evident [41]**.** The new education strategy of World Bank acknowledges the impact of mother tongue-based bilingual education, however the strategy does not contain plans that can help governments to put it into practice [41]. In Nigeria, Late Professor BabatundeFafunwa, who was once Minster for Education, was tagged to be *"the father of mother tongue"* by a lot of people. Fafunwa put the mother-tongue campaign at the top of the education agenda of the nation and it became a debate whether English should indeed be the nation`s lingua franca in 1991 [7][8][25][35][37].Also Professor ChinyereOhiriAniche, the President of the Linguistic Association of Nigeria in 2013 reiterated that the use of indigenous language to teach will help to improve learning [3][11]. In addition, the National Policy on Education (NPE) in Nigeria affirmed that Government should recognize the significance of language as means of promoting social interaction, national cohesion and preserving the cultures; thus the policy endorsed the need for every child to learn the language of the immediate environment [1][4][9]. The need therefore arises for schools to choose between the native dialect (L1) and foreign language for education. In countries where children need to use local, national and international languages, education needs to be multilingual. This means using the language a child already understands for teaching, and gradually introducing second language (L2) or third language (L3) in a communicative way. This can be done from an early age, as long as it continues for the whole of basic education without abrupt changes.

In multidialectal and multicultural community, a multidialectal teaching tool becomes necessary such that education can be brought to the grassroots and be made interesting, easy and acceptable by both the indigenous teachers and pupils. Therefore our aim in this research is to develop multidialectal teaching aid and use simple Arithmetic taught in nursery school in Nigeria as test case. The application will enable nursery school teachers and pupils to teach and learn using dialects in Igbo, Hausa, Yoruba (Nigerian languages) and Ewe (Togolese language).

The rest of the paper is organized as follows: Review of related literature is presented in Section 2. System Design is presented in Section 3. System Implementation is presented in Section 4. Presented in Section 5 is National Policy on Multidialectal Teaching and Learning. Conclusion and Recommendation for Future works are presented in Section 6.

II. REVIEW OF RELATED LITERATURE

A. Works on Teaching and Multilinguality

Teaching is act of communicating knowledge from the teacher (i.e. sender) to the pupils (i.e. recipients). Thus communication is the conveyance or exchange of meaningful information, thoughts or messages between two or a group of people that have a common language or dialect [28]. Teachers can communicate by signals, speech, visuals, behaviour or writing. The teachers give to or receive information about the needs, perceptions, desires, knowledge, thoughts or effective states of the pupils. Teaching can be intentional or unintentional; signals used may be conventional or unconventional; the form used may be linguistic or non-linguistic [20]. *The components involved in disseminating knowledge are: teachers (i.e. knowledge sender), knowledge to be communicated (i.e. message), pupils (i.e. knowledge recipients), the language or dialect for communicating knowledge, communication channel/medium and the tool for communicating knowledge*. Teaching requires that both parties (i.e. teachers and pupils) share an area of communicative commonality. This implies that for a classroom to be well coordinated and interesting to the pupils, the teacher needs to communicate with the pupils in a local language or dialect that is simple and well understood by all the pupils. One of the simplest and no stressful language to communicate with pupils is the mother-tongue language. In this case, the pupils do not need any form of interpretation or going through the stress of learning the classroom language for teaching. Effective teaching should be a bidirectional interaction between the teacher and the pupils. As the teacher teaches a concept, he/she should expect a feedback from the pupils. The feedback gotten will enable the teacher to establish if the pupils understand what was thought. In real life practice where language used for teaching is foreign to the pupils, it is often difficult for a number of pupils to express themselves before their teacher and hence becomes difficult for many teachers to establish how well the pupils understood what was thought. This is common in rural communities where most of the people communicate using the dialect of the community. Though there may be a few pupils in such communities that may easily embrace the foreign classroom language but a large population of the children may be scared of attending school because of the stress of learning the foreign classroom language which they must use to express themselves in the school environment.

Multicultural education can be viewed as a progressive approach for transforming education that holistically critiques and addresses current shortcomings, failings and discriminatory practices in education. Multicultural education is also defined as a process of comprehensive school reform and basic education for all students [9][33][43].A truly multicultural education implies school policies and practices which accepts and respect diversity in the classroom. It means accepting the culture and language of students and their families and embracing them as vehicles for learning.

Researchers have considered developing multi-lingual or multi-dialectal system such that users will be able to communicate with systems in their own dialect or language. Today there are systems that communicate in some languages such as: French, Spanish, Chinese, Arabic, Yoruba e.t.c. The motivation is to enhance ease of use and users understanding of the system and hence enable end users to adopt such

systems for their daily activities. Some related works are discussed below.

It was established that one of the challenges of quality education development is the choice of language and thus people that speak only in mother tongues that are different from the national language, are at a disadvantage in the educational system]43][44]. In addition a World Bank report in 2005 [45] stated that 50% of the children that are out of school in the world live in communities where the language of schooling is rarely or not even used at their homes. Therefore this created the challenge to achieving Education for All (EFA): a legacy of non-productive practices that lead to low levels of learning and high levels of dropout and repetition (World Bank, 2005). In [29], loss of language was stated as a factor that leads to the loss of the following: *culture and knowledge systems, oral literacy and music traditions, cultural practices and artistic skills, philosophical systems, medical knowledge and environmental knowledge systems.* Thus the world may lose a reasonable part of human knowledge whenever a language stops being used and this might be putting us in danger by destroying the diversity of knowledge systems.

In [33], the implication of mother tongue-based multilingual education on education policy was considered. The author established that the problems of education faced by many children from ethno linguistic communities are: (1) *lack of access to education* and (2) *inability to speak the official language in school for the people that have access to education; their language skills could not serve them because their language has no place in the classroom; the language used in their textbooks and for teaching is not a language they neither speak nor understand; therefore, their learning and problem-solving experiences and their knowledge of "how things work" in their own culture and social setting could not serve them because the culture of the classroom, the teachers, and the textbooks is that of the dominant foreign language education society.* The author concluded that the language, knowledge and experience that children bring to school serves as a good foundation for their learning in the classroom and therefore when the children start schooling, they have started gaining confidence in their ability to meaningfully communicate in their mother tongue. More also they have built a foundation of knowledge and experience through observing and interacting with peers and adults in their community.

In [40], the author presented the report on Multilingual/Multimedia Access to Cultural Heritage (MultiMatch) project. The aim of the MultiMatch project was to enable users to explore and interact with online internet-accessible Cultural Heritage (CH) content, across media types and language boundaries. This was achieved through the development of a search engine targeted for the access, organization and personalized presentation of cultural heritage information. The MultiMatch search engine was designed to

(1) crawl the Internet to identify websites with CH information, locating relevant texts, images and videos, regardless of the source and target languages used to write queries and describe the results; (2) identify relevant material via an in-depth crawling of selected CH institutions, accepting and processing any semantic web encoding of the information retrieved; (3) automatically classify the results in a semantic-web compliant fashion, based on document content, metadata, context, and on the occurrence of relevant CH concepts in the document; (4) automatically extract relevant information which will then be used to create cross-links between related material, such as the biography of an artist, exhibitions of his/her work, critical analyses, etc.; (5) organize and further analyze the material crawled to serve focused queries generated from user-formulated information needs; (6) interact with the user to obtain a more specific definition of initial information requirements; and (7) organize and display search results in an integrated, user-friendly manner, allowing users to access and exploit the information retrieved regardless of language barriers. The project was completed in October 31st, 2008 and all planned objectives were achieved. In particular, a multilingual search engine, specialized for searching cultural heritage objects available on the Web and stored in digital archives, was developed and tested and three different field trials were conducted; the field trials experimented the use of the system prototype in different application settings: in the educational field, in the touristic field and for professional archives. The MultiMatch search engine supports retrieval of cultural objects through different modalities. Users can formulate queries in a given language and retrieve results in one or all languages covered by the prototype (e.g. English, Italian, Spanish, Dutch, German, and Polish) according to their preferences. The MultiMatch search engine: (1) is one of the first search engine combining automatic classification and extraction techniques with semantic web compliant encoding standards; (2) considers complex user profiles and search scenarios; (3) can search across language boundaries and across different media.

In [34], the authors spoke about automatically composing a large set of *Wiktionaries* and translation dictionaries that will yield a massive multilingual dictionary whose coverage is substantially greater than that of any of its constituent dictionaries. The composition of multiple translation dictionaries leads to a transitive inference problem (i.e. if word A translates to word B which in turn translates to word C, what is the probability that C is a translation of A?). A novel algorithm was developed by the authors to solve this problem for 10,000,000 words in more than 1,000 languages. The algorithm yields PANDICTIONARY, a novel multilingual dictionary. PANDICTIONARY contains more than four times as many translations than in the largest *Wiktionary* at precision 0.90 and over 200,000,000 pair wise translations in over 200,000 language pairs at precision 0.8. This project was motivated by globalization and more also inter-lingual communication is becoming increasingly important. Although

nearly 7,000 languages are in use today but most language resources are mono-lingual or bi-lingual.

In [24], a description of how multilingual linguistic and lexical information was stored and accessed within the framework of the SEMbySEM project was done. The project aimed at implementing a sensor supervision and management framework which is based on semantic representation. Linguistic and lexical information intervened at two levels: (1) It is attached to the conceptual representation via a lexical ontology that is based on Lexical Markup Framework (LMF) and aligned with other linguistic and lexical standards. Thus the development and maintenance conceptual and lexical representations can be done separately while allowing for a flexible and accurate coupling. (2) At the visualization level, language support was necessary in order to localize the end-user interfaces. XML User Interface (XUL)-based design was used.

In [15], approaches used to build robust multidialectal set of acoustic models were presented with the view to taking the maximum advantage of sharing data across dialects to achieve higher recognition rates. The authors did a comparative study of the multidialectal acoustic models using data from Spanish dialects across Spain and Latin America. It was established that that the multidialectal models have better performance compared to monodialectal systems.

The suitability of using a single multidialectal acoustic modelling for all the Spanish variants spoken in Europe and Latin America was presented in[14]. The objectives were: *(1) "to use all the available databases to jointly train and improve the same system"; (2) "to use a single system for all the Spanish speakers"*. Overall multidialectal acoustic modelling leads to maintain the performance of the recognition system even when it's tested with an unseen dialect (i.e. not seen in the training process).

Presented in [16] was data driven multidialectal phone set for Spanish dialects. Data-driven approach was used to determine a multidialectal phone set for an automatic speech recognition system for Spanish dialects. The decision tree clustering algorithm was used to cluster contextual units of different dialects. The multidialectal system was applied in Spanish as spoken in Spain, Colombia and Venezuela and the results showed differences between phonemes that share the same SAMPA (Speech Assessment Methods Phonetic Alphabet) symbol in different dialects and also detect similarities between phonemes that are represented by different symbols in dialectal variants. The authors established that recognition results using this multidialectal approach outweighed the monodialectal approaches.

In [10], the first phase of Yet another Dialectal Arabic Corpus (YADAC) was presented and it focused on Egyptian Arabic. YADAC is a multi-genre and multi-dialectal Arabic corpus which incorporated data from multiple genres including microblogs, online knowledge market services and blogs. YADAC offered linguistic analyses at the Part-of-Speech (POS) tagging and base phrase chunking. The authors stated as future work, that later phases of YADAC shall deal with Levantine and Gulf Arabic as spoken in the Arabian Peninsula.

In [42], the authors reviewed existing Peer-to-Peer (P2P) technologies and applications and established that over 70% of users of the Internet that were non-English speakers and of which majority of them are academic environment users, were using their native language (e.g. Japanese, Chinese, Arabic, German, Hindi, Urdu etc.). Thus the authors identified the need for multilingual academic P2P environment in order to accommodate the academic members of the faculty and students that were not studying in English and they wanted to share legal and ethical course material or academic related files. In view of this, multilingual academic P2P tools tagged *"A2AShare"*, was proposed. The need to design and develop *"A2AShare"* became imperative because it will help sharing academic materials easily and quickly. The authors are still in the process of clarifying the details of designing *"A2AShare"* and the aim is to develop multilingual system that is flexible and robust and also take full advantage of the current P2P technology. They also proposed to implement *"A2AShare"* tools by developing it as open source.

In [13], an overview of the past progress and current trends of Multilingual Speech Processing (MLSP) was carried out with the view to identifying the emerging challenges of MLSP that will steer up researchers to provide novel solutions. The research was done at Idiap Research Institute. The authors identified statistical machine translation as an influence on the developments in MLSP in the recent years and anticipated that future activity will be strongly driven by web-based services, such as those for mobile devices. They stated that availability of web services, affordability and accessibility of broadband wireless; shall provide the opportunity that will make available a broader range of capabilities to mobile devices, especially those that are based on computationally demanding tasks in MLSP. Thus, they foresaw services being provided by major market players in the domain of speech processing and expected that it will expand to a number of applications in MLSP and consequently increase Research and Development (R&D) activities in both academic and industry.

In [12], the author discussed about multilingual communication and social identification with emphasis on multilingualism in complementary schools in linguistic communities. The objectives were: to explore the social, cultural and linguistic significance of complementary schools that are within the communities and in wider society; to carry out investigation on the range of linguistic practices that are used in the different contexts in the complementary schools; to carry out investigation on how the linguistic practices of students and teachers in complementary schools were used to negotiate multilingual and multicultural identities of young

people. The authors concluded as follows and quoted: *(1) "Complementary schools should provide safe sites for students, teachers and parents to practise their bilingualism and multiculturalism freely and unproblematically"; (2) "Gujarati shalasencourage bilingualism and are at ease with being Asians, Indians and British"; (3) "The shalasmake a conscious effort to provide a Hindu identity, but also encourage compatibility with other religions"; (4) The shalasencourage Indian nationalism but also British patriotism; (5) "Parents are keen for their children to learn Gujarati and acquire cultural knowledge (that mainstream do not provide)"; (6) "Students are proud to be Gujaratis and wish to learn Gujarati and become successful citizens of UK"; (7) "Students do resist essentialist or absolute 'identity', they skilfully juxtapose their own 'British Asian' identities (use of English and peer group culture)"; (8) "For the shalas, language is both an instrument and identity marker (in contrast to the mainstream MFL* (Message Format Language) *approach)"*

Organic.Lingua project was presented in [21]. The project was funded by European Union (EU) and it was aimed at delivering a Web portal that provides automated multilingual services and tools facilitating the discovery, cross-lingual retrieval, exploitation and extension of digital educational content related to Organic Agriculture and AgroEcology. The web portal supports multilingual construction of agricultural content. The cros-lingual facility services of the web portal enable users to: *(1) "find resources in languages different from the ones in which the query has been formulated and/or the resource described"; (2) "manage meta-data information for resources in different languages"; and (3) "contribute to evolve the content (i.e providing services supporting the users in the content generation)".*

In [6], the authors conceptualized and developed a multilingual and multi-denominational software for Automated Teller Machine (ATM). Three Nigerian languages (i.e. Yoruba, Hausa and Igbo) plus English language were defined in the system. Thus the ATM communicates in these languages with the users. The adoption and incorporation of the software in ATMs will help to enhance the ease of use by customers and hence reduce frustrations of using ATMs by rural dwellers because they could communicate with the machine in their local language.

B. Some Research Works in Nigeria on Teaching in Mother-Tongue

In [36], it was established that contemporary language literacy in Nigeria was fraught with constraints (e.g. lack of orthography for a large proportion of Nigerian languages) and thus prospects for mass literacy were not encouraged. They recommended that the Federal Government of Nigeria should direct its efforts towards developing orthography and literature in many indigenous languages that are unwritten. Also, there should be policy that will clarify what it means to be literate locally, regionally, and nationally.

In [2] empirical investigation was carried out on the problem of non-proficiency in language learning and use among students in Nigeria and it was observed that lack of fit between the formulation, planning and implementation of national policy for national (macro-) language led to the language deficiencies of the students. This was attributed to the complexity of the socio-cultural, multilingual and multi-ethnic context of the nation.

In the work of [17], poor performance in examination and low proficiency in English in Nigeria were indicators that language teaching and assessment did not sufficiently engendered effective language use. Thus, local languages play little or no role in personal advancement and as a result the society is unable to utilize potential manpower side-lined by poor achievement in English language tests. In view of this, examining bodies and curricula designers should emphasize their philosophies and practice in order to align language teaching and assessment with national development goals and international best practice.

In [31], the author investigated how students' competence in the language of instruction could predict their performance in History subject in Secondary School History. The author sampled 505 form IV students of History in 11 secondary schools. The students' competence in English language was measured through the Progressive Achievement Test (PAT) in English comprehension and vocabulary and performance in History through History Achievement Test (HAT). The author established that there is a positive correlation between competence in English Language (i.e. the language of Instruction) and academic achievement in History. Similarly, [39] observed that students' performance in Biology was falling in Nigerian secondary schools and thus conducted the research on whether the use of mother tongue approach to teaching and learning in Nigerian secondary schools could impact positively on scientific development. The research was conducted in four schools in Ondo West Local Government Area in Ondo state of Nigeria. The tested pupils were taught in Yoruba language (mother tongue language) and English language (a foreign language) and the authors established that there was significant difference between the pupils that were taught with Yoruba language and those that were taught with English language. Therefore, they recommended that considerable effort should be made to encourage teaching pupils with indigenous language (mother tongue language) at all level of Education; however, foreign language should be used to complement this.

In [38], the author examined the policy of mother-tongue medium of instruction as a means of challenging educational disadvantages and thus enhance sustainable development in Africa. Based on empirical review and analysis done, the author stated that illiteracy rate was about 70% in Africa and also reported that the report of Education for All Global Monitoring programme done by UNESCO in 2010 showed

"Africa is lagging behind in the Education for All 2015 objectives". In view of this, the author therefore considered the efforts made in Africa regarding mother-tongue projects and established the need for a pragmatic approach to the medium of instruction such that mother tongue and foreign languages will be on an equal basis and thus prevent the creation of a psychological gap that may be detrimental to all cognitive maturation and intellectual development of a child.

C. Deductions from the Literature Reviewed

Presently Nigeria is composed of more than 250 ethnic tribes with language and cultural diversity. The three largest and most dominant ethnic groups are the Hausa, Yoruba and Igbo. Other smaller groups include the Fulani, Ijaw, Kanuri, Ibibio, Tiv and Edo. These ethnic groups have separate and independent histories, diverse cultures and languages. The official language is English. However, some of the country's population do not understand English. Furthermore, Nigerians prefer to communicate in the indigenous languages or in one of the three dominant languages. Language and cultural diversity is not peculiar to Nigeria; there is diversity of languages and cultures in many countries around the globe. This is a pertinent contextual issue that should be taken cognisance of during technology development in order to facilitate the adoption and good usage of any technology.

The following are the deductions established from the literature reviewed: *(1) There are multi-lingual technologies that exist and are being used in systems such as voting and mailing system; there are a few educational software but none so far has been multidialectal software. (2) There is need for a multidialectal teaching aid for the present society with language and cultural diversity and this aligns with the National Policy on Education (NPE). (3) Computer literacy should be emphasized such that teachers and students will be able to adopt and use multidialectal teaching and learning software.* These deductions formed the basis of the multidialectal training system proposed in this paper.

III. SYSTEM DESIGN

A. Architecture of CAMTS

Software architecture is the structure or structures of the system, which comprise software components, the externally visible properties of those components, and the relationships among them [5]. In addition to specifying the structure and topology of the system, the architecture shows the correspondence between the system requirements and elements of the constructed system, thereby providing some rationale for the design decisions. The software architectural design patternused is Service-Oriented Architecture (SOA). The architecture is divided into three subsystems: (1) the user interface, (2) the system kernel and (3) the output unit. The system architecture is presented in Figure 1 and the relationship diagram of CAMTS data files is presented in Figure 2.

User Interface subsystem: This is the unit through which the users (i.e. teachers and pupils) interact with the system by clicking on the icon of any selected operation of CAMTS.

Dialect Selector unit: This unit is where the dialect will be selected. Teachers and pupils can interact with the system by selecting any of the following dialects: Ikwuano (Igbo dialect), Egun (Yoruba dialect), Kanuri (Hausa dialect), Ewe (Togolese dialect) and English language.

Pupil Activity subsystem: this is the subsystem where all teaching aid operations are initiated for processing. The modules for carrying out the operations are invoked by this subsystem. The operations are as follows: Arithmetic operations (i.e. Addition, subtraction, multiplication, division and counting), Language selection and Data management.

Report/Output unit: this is the subsystem where all reports about operations carried out are generated for the system and teachers to crosscheck and view or print when needed.

Data Manager subsystem: this subsystem is responsible for managing the files kept for the system. The names of the files envisaged for CAMTS are: *Pupil, Pupil activity, Number identification, Number tracing, Sound manager, Language, Main activity, Writing*. The logical relationships between the files are presented in Figure 2.

Sound Manager: this is responsible for the functions of sound dispatcher, sound API and audio system.

Algorithm of CAMTS

Below is the algorithm of CMTS:

Step 1: (a)Animator animates the user interface with the object
(b) The display navigator displays the object.
Step 2: (a)Select the language of your choice language i.e. (English; Yoruba; Igbo; Hausa; Ewe).
(b) Event manger accepts the input
(c) Pupil Activity Management System queries the language selector
(d) Language selector returns the desired language.
(e) The user interface is populated with the selected language
Step 3: (a)Create the pupil or student profile (i.e. [Name, Class, Age]).
(b) Pupil profile is stored in the file manager (for availability of the student profile)at any instance
Step 4: Select the activity for the student. Activity include [Number counting, addition, subtraction, multiplication, division]
Step 5: (a)If activity selected for pupil is Number counting then go to Step 6
(b) Else go to Step 4

Step 6: (a)   Pupil Activity Management System queries the arithmetic operator

(b)   Arithmetic Operator then returns the Activity to the pupil activity system

(c)   Pupil activity management system also fetches the sound from the file manager

(d)   Pupil activity management system feeds back the user interface

Step 7: If the activity selected is addition go to Step 6. Else go to Step 4

Step 8: If the activity selected is subtraction go to Step 6. Else go to Step 4

Step 9: If the activity selected is multiplication go to Step 6. Else go to Step 4

Step 10: If the activity selected is division go to Step 6. Else go to Step 4

Step 11: Algorithm terminates.

B. System Implementation

The multidialectal system is basically meant for the pupils but the tutor or a teacher can help in putting the pupils through. Each pupil will have their account and can perform different activities such as: *addition, subtraction, division, number counting and multiplication.* This system supports carrying out of these activities in different dialects. When a dialect is selected, everything on the page is done in the dialect. This system consists of the following pages: (1) Front page; (2) Dialect selection page (where the dialect of choice is been selected default is English); (3) Home page (This is where the pupil profile is been added to the system); (4) Main activity page (This is where the different activities are listed); (5) Number counting page; (6) Multiplication page; (7) Subtraction page; (8) Division page; (9) Addition page; (10) Exercise page. Sample screen shots are presented in Appendix A.

IV.   National Policy on Multidialectal Teaching and Learning

A. The Federal Rebublic of Nigeria: National Policy on Education (NPE)

The development of multidialectal teaching system for teaching and learning in Nigerian schools aligns with the de facto National Policy on Languages in education in Nigeria as presented in [1][4][22][30]. The policy recognizes the multidimensional, multi-lingual three tier political-polity which tries to capture the multi-ethnic and, ipso facto, multi-lingual polity which Berlin and the British have hammered into a rough-hewn existence. The Policy provides for the following:

a.   Mother-Tongue (MT) and\or Language of the Immediate Community (LIC) as the Language of initial literacy at the pre-primary and junior, primary levels, and of adult and non-formal education.

b.   The three major national languages - Hausa, Igbo and Yoruba at L2 as the languages of national culture and integration.

c.   English - the official language - as the language of formal literacy, the bureaucracy, secondary and higher education, the law courts, etc.

d.   Selected foreign languages especially, French, and Arabic, as the languages of international communication and discourse. These are the languages for which language villages have been set up.

In terms of unstated policy, the National Policy on Education (NPE) on languages in Federal Republic of Nigeria: (i) Advocates multilingualism as the national goal; (ii) Recognizes English as the de facto official language in the bureaucracy and all tiers of formal education; (iii) Treats Hausa, Igbo and Yoruba as potential national languages which are to be developed and used all through the formal educational system; (iv) All Nigerian languages as meaningful media of instruction in initial literacy, and in life-long and non-formal education.
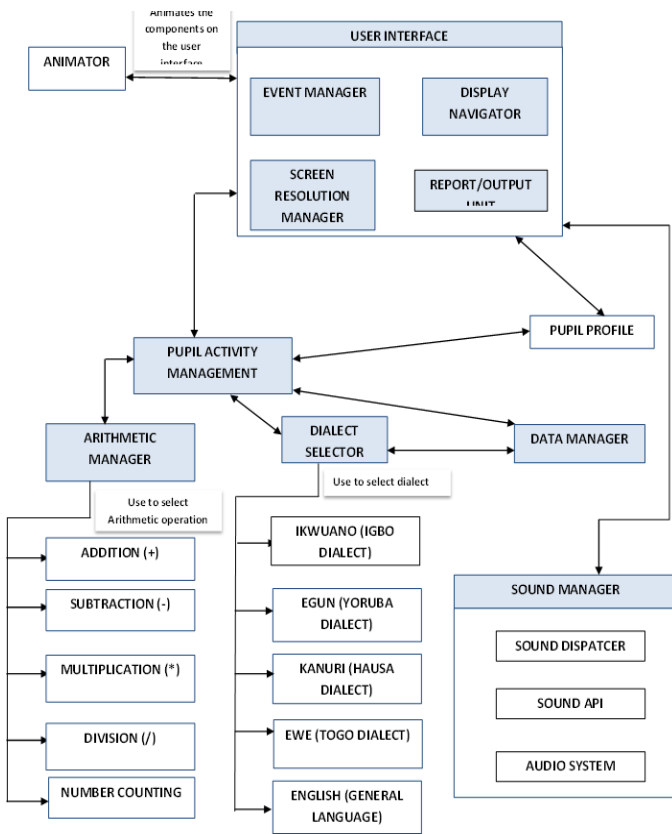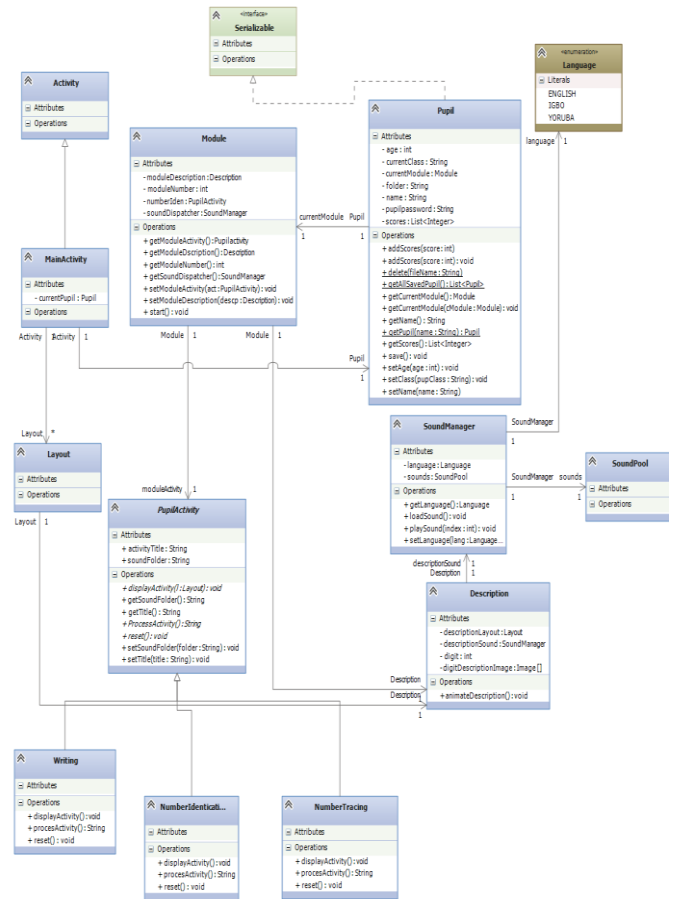
Figure 1   Architecture of CAMTS

Figure 2:   **Relationship Diagram of CAMTS Data Files**

V.   CONCLUSION AND FUTURE WORKS

Teaching kits are essential to help children learn outside the conventional classroom environment. The multidialectal software (CAMTS) proposed in this paper will serve as artificial teaching assistant to the teachers to teach pupils in their mother-tongue dialect. CAMTS stands out from the normal teaching kits, because of the introduction of different dialects, using dialects in Igbo, Yoruba, Hausa, and Togo as case study. African children can have a way to interact with the day to day school work in a dialect they are conversant with. This will bring about improvement and if adopted and used, it can be a means to minimize illiteracy. However, it does not mean that there will not be few individuals that may not be able to use the system. We believe that the use of dialectal approach to teach pupils (particularly those in the rural communities), will encourage both parents and children to embrace schooling and thus be educated. Moreover, the phobia that may be created in the mind of some children by the use of western languages (e.g. English and French) in schools will be minimized.

The adoption of multidialectal system for teaching will have some implications in the educational policies in some countries (e.g. countries that only accept western language such as English (e.g. Nigeria) or French (e.g. Cameroon) as their lingual franca). Such countries may have to modify their educational policy in order to embrace and implement dialectal approach to teaching in their schools. For example NPE policy in Nigeria supports mother-tongue teaching and learning in schools. Though schools are given the option of using at least one major Nigerian language (e.g. Yoruba, Hausa or Igbo) for teaching but in practice, many of the schools do not implement this because parents want their children education in English language because it is the official and global language for communication.

Moreover, the use of computer based teaching aids like CAMTS, implies that both the teachers and the pupils must be computer literate to some extent and thus be able to relate with computer systems without fear. Also teachers and parents should be able purchase computers and the software at affordable prices. This implies that both government and private sectors should have good policy to support procurement of computer infrastructure for schools. In this way both teachers and pupils with low level income can have access to the computer facilities owned by the schools for teaching.

The European Commission in 2008stated and quoted: "*A successful multilingualism policy can strengthen the life*

chances of citizens: it may increase their employability, facilitate access to services and rights and contribute to the solidarity through enhanced intercultural dialogue and social cohesion" [23]. Thus having computer based systems with multilingual functionality is not out of place as this will enable end users particularly those in the rural communities to communicate with the computers in their mother-tongue language.

CAMTS application is a multidialectal training kit and we target the age group of 3 years to 5 years old that are still in Nursery schools. The system addresses only basic Arithmetic (i.e. number counting, addition, subtraction, multiplication and

division). Researchers can put the following into consideration for future works:

a. Development of teaching aids for students in age group that is above 5 years

b. Enhance CAMTS to teach all Arithmetic and Mathematics operations.

c. Enhance CAMTS to teach other subjects

d. Improve on the functionalities of CAMTS in order to accommodate the dialects of other countries.

e. Improvement on the system such that physically challenged pupils (e.g. deaf, dumb and blind) can use it for learning.

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APPENDIX A
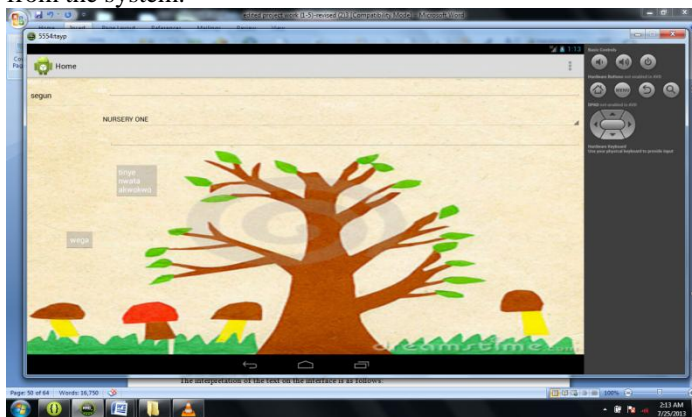
i.   Dialect Selection Page

This is the page where the dialect of your choice is selected.

Dialect Selection Page

ii.   Home Page

This is the page where pupils' details are added to/removed from the system.

Home Page

The interpretation of the text on the interface is as follows:
'*Wega*' → Remove; '*tinyenwataakwokwo*' → add pupil; '*afa*' →Name; '*nka*' →Age; '*mpioanya*' → *?*

iii.   Main Activity Page

This is where the different activities are listed. A dialect in Igbo community of Nigeria is used here.

Main Activity Page

The translation of the text on the interface is as follows :
'*Ogugu*' → Number Counting; '*Mmoba*' → Multiplication; '*Nwepu*' → Subtraction; '*Nkebi*' → Division; *'Ngbako'* → Addition; *' 'gbatia'* → *?*

iv.   Number Counting Page

This page is in charge of the number counting tutoring. The page displays a number and writes the number in words with respect to the dialect selected. This page is also embedded with a voice aid that helps the kids to pronounce the number. A dialect in Igbo community of Nigeria is used here.


Number Counting Page

The translation of the text on the interface is as follows:

'*Ajiya*' → previous; '*Gobe*' → Next; '*Biyar*' →Five;

v.   Multiplication Page

This is the page where the multiplication operation is been carried out. It displays a random number then multiples it by another random number then the result is been displayed. There is also a voice aid in any of the dialect to put the pupil through. The system speaks to the pupil in an Igbo dialect of Igbo community in Nigeria.
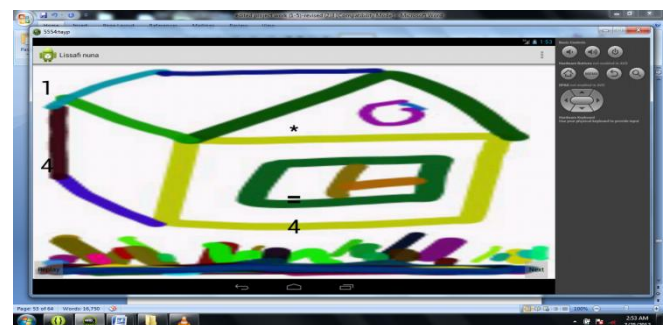

Multiplication Page

vi.   Subtraction Page

The subtraction operation takes place in this page. It displays a first number and it ensures that the first number is greater than the second number in other to avoid negative value which might confuse most nursery school pupils. A voice aid is also embedded in this page to help them through the tutoring. The system speaks to the pupil in an Igbo dialect of Igbo community in Nigeria.
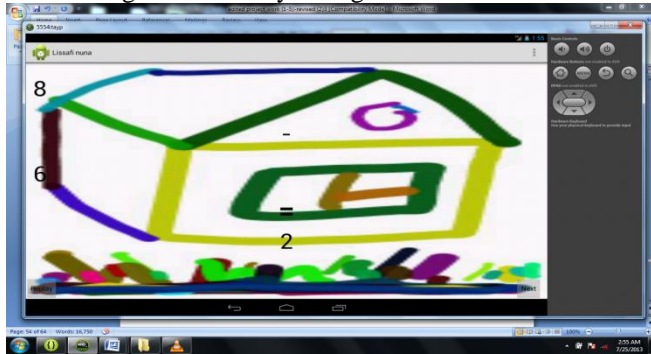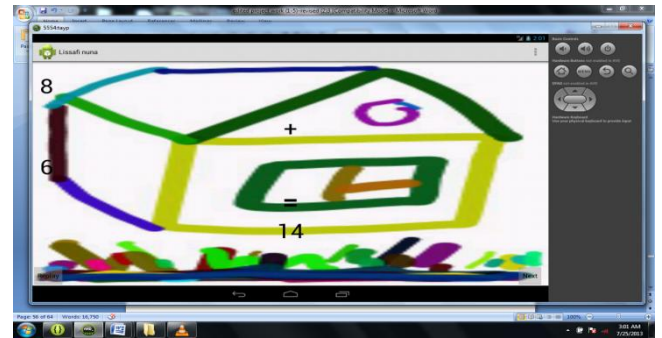

Subtraction Page

vii.   Division Page

The division operation takes places on this interface. The interface displays the numerator first and then the divisor and finally the answers. The system ensures that the numerator is greater than the divisor and that there would be no remainder. The system speaks to the pupil in an Igbo dialect of Igbo community in Nigeria.

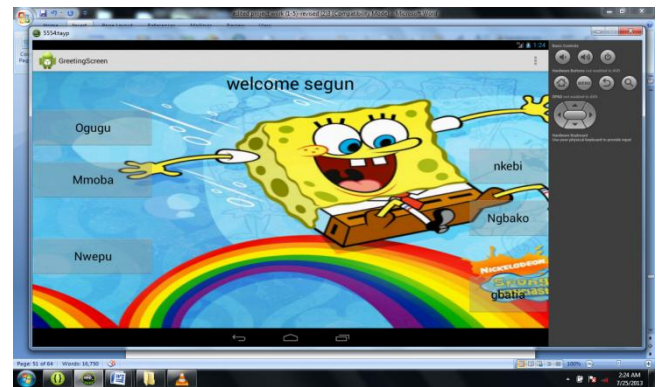**Division Page**

viii.   Addition page

The addition operation is carried out on this page. The interface pops out two random numbers and sums them up for the student and the voice aid also helps them through. The system speaks to the pupil in an Igbo dialect of Igbo community in Nigeria.

Addition Page

ix.   Exercise Page

The exercise page is in charge of giving the pupil exercise. The exercise could be in form of counting, Addition, Subtraction, Division and Multiplication. The system speaks to the pupil in an Igbo dialect of Igbo community in Nigeria.

Exercise Page

The translation of the text on the interface is as follow:
  'Mmoba' →Mulitiplication; 'Nwepu' → Subtraction; 'Ogugu' → Number Counting; 'Nkebi' → Division; 'Ngbako' → Addition