

The Development and Deployment of a Mobile Music Application for Literacy Enhancement (M2APPLE)

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Abstract

We present in this paper the design, implementation, and broad scale deployment of a Mobile Music Application for Literacy Enhancement (M2APPLE) that leverages the fun activity of Karaoke music as a motivational and complementary tool for learning English as a second or even third language. English language illiteracy is a particularly endemic problem for a vast majority of youth in Northern Nigeria who are consequently disadvantaged since English is not just the language of governance but is the lingua franca for commerce and much else across the entire country. M2APPLE leverages the full potential and portability of Hyper Text Markup Language (HTML) 5 for a complete client-side application that runs seamlessly on mobile and non-mobile technologies alike.

Keywords: Karaoke music, English Language illiteracy, learner-centered learning, mobile technology, hypermedia

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Introduction

Music has been widely researched and employed as an important tool for, and complement to learning, especially within informal settings. Music is widely used in early learning of phonetics, word recognition, counting, etc.; in general, as a motivator for the learner to improve their level of literacy, build their vocabulary base and gain some level of confidence (Gupta, 2006). Illiteracy has been identified as a major hindrance to the socio-economic development of much of the developing or so “third” world. Such is the case for Nigeria, in spite of speculations and indicators that Nigeria is on a fast trajectory to emergence as an economic power house on the African continent. Illiteracy, and especially youth illiteracy, which is particularly endemic in the densely populated Northern parts of Nigeria, becomes a major impediment to this economic development. It also adds to the security challenges facing this region of the country (Ojong & Ejar, 2018), (Akpan, 2015). The insurgency in the North-Eastern region of Nigeria, largely perpetuated by Boko Haram, easily breeds on illiterate youth. As a development University, and in recognition of the added danger posed by the Boko Haram insurgency, the American University of Nigeria (AUN) in Yola has mounted many initiatives to help improve the level of literacy in the State of Adamawa and beyond. One such is TELA (Technology Enhanced Learning for All) which leverages such technologies as Radio and mobile tablets to impact on this problem. Our research effort, part of which is reported in this paper, adds a dimension to the TELA initiative and focuses on developing a mobile application, code-named, M2APPLE (Mobile Music Application for Literacy Enhancement) that leverages the fun activity of Karaoke music as a motivator and complementary tool to learning and building the vocabulary of illiterate youth in Northern Nigeria. M2APPLE leverages the full potential and portability of HTML 5 and related technologies for a complete client-side application that can run seamlessly on mobile and non-mobile technologies alike. It is built as a progressive web application (Gatsbyjs.org, 2019), that is, as a modern, offline-capable, cross-platform mobile web application. The explosive growth of the mobile phone industry in Nigeria and Sub-Sahara Africa, coupled with the growing integration of web and mobile content on smart phones presents a very real, viable and affordable opportunity for bridging the knowledge barrier that has simply not been there before for the developing world. On the pedagogy front, research has shown time and again that learner-directed learning is far more effective than instructor-led [Terry Anderson, 2008] and developing life-long learners is becoming a common learning outcome for many an educational institution. M2APPLE puts the learner in the driver’s seat and not only allows them to pick and choose songs of their liking to play and learn from but they can also interact with the system as a song is being played to learn words/phrasal translations and/or to get a better handle on word phonetics. The direct relationship between a learner’s vocabulary bank and their level of confidence has been known for some time now (Turnbull, Gupta, Murad, Barone, & Wang, 2017), (Rengifo, 2009). The overall purpose of M2APPLE is to help increase the learner’s vocabulary pool in order to increase their level of confidence. The second author of this research has experienced first-hand the motivational force of music in learning a new language and believes he was able to quickly build and grow his vocabulary base in the Portuguese language because of his connection with and influence of Brazilian music he employed to quickly learn the Portuguese language while on his first major post-PhD job teaching at a University in Brazil. He recounts that his love for a song that was being played provided the impetus to invest time in finding out the meaning of the words behind the music, further expanding his vocabulary pool and with that his confidence in speaking the language. The rest of this paper is organized as follows: in the next section –

section 2, we introduce the problem of illiteracy and its specific manifestation and impacts in Nigeria. In part 3, we review the literature on the use of music as a motivator to learning a new language. We look at Karaoke music in particular, and how it has been employed to improve the learning of a new language. In part 4, design and implementation, we first present important design and implementation considerations or objectives for the system and then elaborate on the enabling technologies supporting our M2APPLE system and how these have been strung into a system to meet the objectives. In Part 5, we critically evaluate our implementation and deployment for use, outlining some important contributions and some pointers for future work.

Background

Since independence in 1960, Nigerian leaders, scholars, and institutions have initiated many efforts aimed at improving the level of literacy of Nigerian youth. Unfortunately, most of these efforts have not had the impact hoped for, especially in the North. Today, youth and adult literacy in the English Language remains a critical determinant for improving the livelihood of individuals, their families and the country at large. According to (Omolewa, 2006), ‘before we can conquer poverty, ignorance and disease, we must first conquer illiteracy; because illiteracy is the most serious handicap for economic, political, social and individual development’. (Tella, 2015) cites illiteracy as one of the major causes of the Boko Haram insurgency. The United States Institute of Peace listed ignorance of religious teachings, poverty and unemployment and high levels of illiteracy as linked to youth radicalization and extremism. Before the UN’s effort, education experts monitoring the activities of UNESCO, United Nations International Children’s Emergency Fund (UNICEF), Action AID, British Council & United States’ Agency for International Development (USAID) had made two sanctions: (1) the need to establish a literate and learning society using innovative approaches (Tahir, 2005), some of which include Each-One-Teach-One, Literacy Shops, distance learning, etc.; (2) the need to expand our current educational system to allow adult men and women access to education. Too many adult Nigerians, especially in the Muslim North, are disadvantaged for religious or financial reasons, and so are deprived of their right to basic education which is achieved mostly through classroom learning at a young age. Illiterate children (whether rich or poor) grow up with low self-esteem; when they go to hospitals or banks or court houses, they cannot communicate with the nurses, doctors, cashiers, etc. so they are forced to find interpreters or to resort to other ways to solve their problems. To reduce this inherent disadvantage associated with high illiteracy rate in the Northern Nigeria especially, it is necessary to develop innovative approaches that are self-applicative and can be used at any time and from anywhere. This research proposes to implement a mobile application code-named M2APPLE: Mobile Music APPLICATION for Literacy Enhancement, with the broader goal being to expand access to education and command of the dominant English Language by leveraging mobile technology and promoting lifelong learning (Omolewa, 2006).

2.1 Broad Goals Of The Research

As a Development University, the American University of Nigeria (AUN) has led many initiatives to alleviate many social ills in Yola and the wider region of Adamawa State. These include the Adamawa Peace Initiative (API), Student Empowerment Through Language, Literacy and Arithmetic (STELLAR) and STEM Projects. Another initiative also aimed at improving the literacy level across all age groups, especially the young and adolescent, was

code-named TELA (Technology-Enhanced Learning for All). TELA is a program that proposes to offer basic reading and math lessons through radio and mobile technology to some 20,000 Nigerian children and adolescents, orphaned, displaced, homeless or at-risk (American University of Nigeria, 2016). However, TELA targets mostly children within the ages of 5 to 15, even though it shares the same broad purpose of ‘learning for all’. M2APPLE is an off-shoot of TELA that seeks to leverage the fun-activity of Karaoke music on mobile devices to help illiterate youth improve their spoken and written English by building up their vocabulary. The M2APPLE application aims to employ popular, catchy local, national and even international songs and their lyrics to improve their spoken and written vocabulary in the English language. It specifically targets Nigeria Youth, some of whom are already fluent in other languages (Hausa in particular). The widespread availability of smart mobile phones with internet access and sufficient computational power to run the intended application means it should be more widely available to just about anyone with some appreciation of music (teenagers and above), and eliminates having to train anyone on how to use it, since most of them already use smart phones. The mobile domain also provides huge opportunities to the various institutions interested in this problem. Ease of use, portability and scalability are important objectives of the system.

On the Use of Karaoke Music in Learning

Karaoke is a musical entertainment activity that originated in Japan. Typically, a singer on stage sings along into a microphone the lyrics of a song displayed on the screen, while the instrumentals are played in the background. The background music could also be vocalized depending on the singer’s preferences and confidence level. Karaoke has mostly been seen as a fun activity and stereotypically happens in social settings such as at parties. However, web and mobile technologies have helped redefined what karaoke represents, where it is done and who does it – it can happen anywhere and everywhere today! When used to support learning, it has been seen to be highly motivating for learners of all age groups (Gupta, 2006). It is an important complement to learning a new language, especially for music lovers and for a language and culture of music such as English with some of the best music in the world.

3.1 Music & Literacy

Most countries, especially Nigeria, have come to the realization that literacy must not necessarily only be achieved through formal education but also through distance learning; so, the delivery medium to achieve this must be ‘inclusive’ of the many, not ‘exclusive’ of the few (Aderinoye, 2008). This ‘delivery medium’ must, however, be multi-faceted; and what better medium than the use of Information and Communication Technologies (ICTs). In (Haddad, 2007)’s words, “to tech or not tech education is not therefore the question, the real question is how to harvest the power of ICTs to make education relevant, responsive and affective for school settings and lifelong learning for anyone, anywhere, anytime”. However, in (Aderinoye, 2008), Rashid argues that until such a time as we begin to remember that ICTs are not just limited to computers, we probably would not fully leverage ICTs as a channel to enhance literacy, especially ‘distance learning’. He reminds us that ICTs include radios, mobile phones and tablets, televisions, and prints, all of which are cheap and readily available in our homes, and more importantly have better penetration, culturally and geographically speaking, than our precious computers; although computers bring a certain degree of ‘interaction’. He discusses the three learning revolutions the world has seen so far. First was the discovery of the ‘written

language', the second was the expansion to moveable books and types, and the third ICTs. He calls them 'revolutions' and opines that ICTs alone have the ability to prepare us to become life-long learners because of their ever-changing nature. This, he describes as a move towards the 'constructive learning theory' (Anderson, 2008). The 'interaction' mentioned earlier regards Haddad's view that ICT applications have not only succeeded in making learning socially interactive, but also take into consideration the learner's abilities and needs. For instance, most literacy apps have different 'levels' categorized typically as novice, advanced beginner, competent, proficient, and expert following the (Dreyfus, 2004).

Because ICTs as literacy tools, especially mobile phones and computers have to some extent penetrated the geographical barrier, Haddad has interestingly split them into two. The first category, technologies in location, includes "digital notepads, mobile phones, printed materials, CDs, films & videos, scanners, slides, etc." The second category, which comprises "correspondence, radio, television, web pages, web internet, webcasts, etc.", are technologies of distance. They both integrate audios, videos with tools such as emails and chat rooms to promote synchronous and asynchronous interactions amongst learners". The general use of Karaoke music in teaching and learning as in the works of (Israel, 2013), (Sigurðardóttir, 2011) and (De Cristofaro, 2011) fall in the first category. Both authors employed Karaoke music as an entertaining, motivational and complementary tool for learners in the classroom to improve the pronunciation and communication skills of the learners and as a medium that encourages more practice and collaborative learning amongst the students since students can take turns to sing and sing in groups too. Qualitative assessments of past works concluded that karaoke did indeed improve students' pronunciation challenge. Even better, it boosted their confidence greatly because it was observed that the learners interacted more freely during class exercises; all the while communicating in English and trying to accomplish classroom tasks together. Our system shares the same goal with previous works to advance the communication skills of the learner in the English Language in order to improve the learner's economic welfare. It targets youth who are already conversant in another language such as Hausa, or Fulfulde or Yoruba, but are practically illiterate in the dominant English Language - the national language of commerce and governance in Nigeria. M2APPLE qualifies as innovative because it meets the two criteria sanctioned by Nigerian education experts (Tahir, 2005): first, it proposes to use technology to enhance learning and secondly, it 'includes' every English illiterate Nigerian: not just youth, or children. The latter translates to distance learning. Distance learning is advantageous according to (Aderinoye, 2008) for 2 reasons; it uses 'multimedia' to deliver educational services, and it ensures access equity for all, even though M2APPLE mostly targets illiterate youth who can already reason for themselves. M2APPLE can be used locally within a class or at distance by learners doing their own self-applicative learning.

Design & Implementation Of M2apple

We have stated already an important design consideration for M2APPLE as a mobile application to support learning for all. To achieve this, two important design considerations are ease-of-use and broad accessibility to the majority of learners and learning environments. We add to this scalability or the ease with which a solution can made widely accessible to a larger pool of users as the need arises. Implementation as a web application that is portable across device types should guarantee both the ease of use requirement as well as go some way to fulfilling accessibility need. Guaranteeing portability and deployment as a mobile app will go a

long way to meeting the latter goal. A solution and deployment strategy that can be easily replicated should address the goal of scalability. As this system targets youth who can already speak a second language, an important end-user goal is to provide more active user interactivity with the system than is available with the typical Karaoke session where the actor simply reads off a screen. An important design objective is support for an interactive word and phrase dictionary that the user can explore to find out the meanings of words and song lines as they learn English.

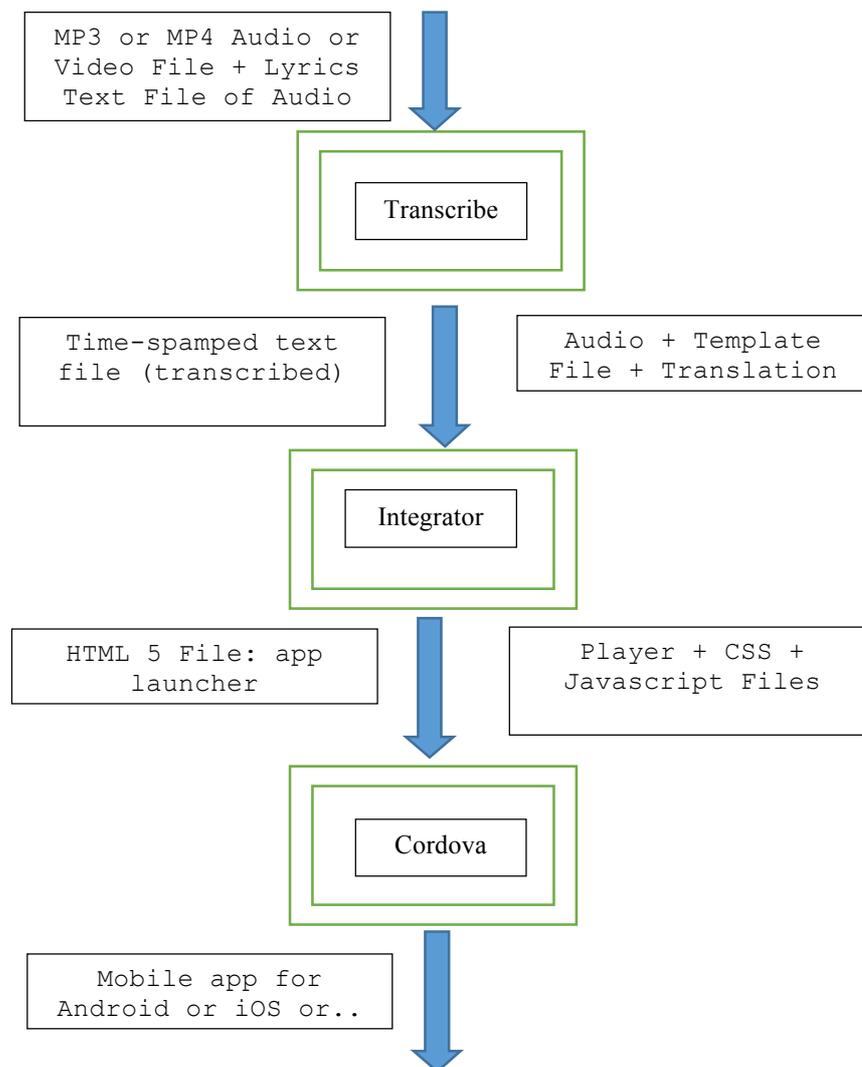


Fig 1: *Architecture View of System Components, their Inputs, Outputs & Interconnects*

M2APPLE is made up of the following key components, technologies and functions.

1. A Creative Studio component made up of the Transcribe Software System used for audio to text transcription. It takes as input an audio file of a song and its lyrics as text within the text area of its window and spits out a time-stamped text or word file of the lyrics with start and end times for each line, or word of the song. We delimit on lines not words. A good part of this involves some user action in delineating the start and end parts of the lines of a song.
2. A standard Player + template HTML file: the player (jPlayer) is a Javascript audio player deriving from the hyperaudio project (HyperAudio). Hyperaudio permits to weave audio into normal HTML providing to audio that capabilities like search, jump etc.
3. An Integrator is a piece a software module that serves to build or flesh out the template HTML file using as input the time-stamped text-file of the lyrics, its translation file, and the name of the audio-file. The output of the integrator is an html file that serves as a launcher for the player or Karaoke system.
4. Mobile App Generator: this is really an extension of the Creative Studio in 1. aimed at generating a mobile version(s) of the application for the different platforms, principally Android and iOS systems. The main technologies employed for this generation are the open-source Cordova system – an off-shoot of Phonegap from Adobe.

5.

Fig 1 is a sketch of a high-level System Architecture showing how these components fit together, their inputs, outputs and the technologies driving each component. Inputs into each component of the system are shown both to the left and right of the input arrow while the outputs of any module are the ones shown to the left of the output arrow from that module.

Assessment Of Implementation & Deployment

M2APPLE is a cross-platform implementation and adaptation of Karaoke music to support, motivate and advance the learning of English by Youth in Northern Nigeria as a second or even third language. It is principally intended to be run on mobile devices. However, by employing open standard and open-source technologies the application can be run on any platform supporting a web browser. We set out 4 design goals for M2APPLE – ease-of-use, accessibility, scalability and enhanced user interactivity. To a large extent our implementation has addressed all four. Ease of use and accessibility are assured by implementing the system as a cross-platform web application that can run seamlessly on mobile devices including mobile phones and personal computers. To support and advance the University's TELA illiteracy intervention measure and deliver a system that can scale to support an even larger group of learners we not only stuck to open source and open standard web technologies (HTML, CSS3 and Javascript) but we automated the generation of a single launcher HTML file that embeds the text lyrics of a song and its translation dictionary. All other components of the system, namely the Javascript player and CSS files remain the same and can be easily replicated. On the final design goal of interactivity, not only do we provide a fully integrated phrase dictionary but the user can access this while a song is being played by simply hovering the mouse over a line of the song for a

display of the translation of that line into the learner's native language. For our first implementation, Hausa served as the main language we translated into given its very broad adoption in Northern Nigeria, and in fact across much of Sub-Saharan Africa. However, it is an easy matter to translate to other Nigerian languages and employ the same application in other parts of the country. One of our design goals was ease of scalability of an implementation so that it can easily be made available where needed. To meet this goal, we opted for a simple design with just one HTML file carrying the lyrics and its translation. This file can be easily edited by hand to change the translated text to another language. To further facilitate this process, we defined an Integrator module that will take as input the time-stamped transcribed lyrics, its translation into another language and a template HTML file and produce an HTML launcher file for the application. This should greatly ease scaling of the application. We have so far received very positive feedback from key stakeholders on the TELA project, principally the field instructors who employ tablets for teaching. Most of this is anecdotal though. An important remaining part of the assessment will come after actual deployment and use by the Youth themselves.

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