
# HISTORY OF COMPUTING IN AFRICA: A HISTORICAL PERSPECTIVE OF THE DEVELOPMENT OF COMPUTING IN EDUCATION A CASE STUDY OF MALAWI

**INITIAL REPORT FOR THE MSC DEGREE IN COMPUTER SCIENCE**

**WRITTEN BY GIBSON PILIRANI DZIMBIRI (ID NUMBER: 920768)**

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**Abstract**

This paper will explore the history of computing in education in Malawi, both in universities and schools, from 1980 to the present. The study will examine scientific research papers, reports, national ICT policies and conference proceedings. We will involve conducting a general interview targeting various past and present students, lectures, and staff in different universities and schools.

The aim is to determine the gradual development of computing and its impact on Malawi's education for the past fifty years. The study will reveal the progress in recent years as the country had embarked on developing and implementing reforms on infrastructural development and policies that promote using ICT in education for effective teaching and learning. We will further look at the impact of political will in developing computing in academic circles.

Malawi is among the countries in the sub-Saharan region to benefit from donor communities in computing in the form of computer hardware and software and skills development. This support has been prominent in the education sector because it is difficult for government-owned academic institutions to buy computers and software using their meagre resources. Despite such partners' support, there is still a gap in establishing proper structures to help universities and schools advance with technology. The above limitation has, for several years, drastically slowed down the inception of computing in the country.

Our research will unveil the historical development of computing, why and how it was incorporated into the education system, and the influence it has had in promoting education in different academic departments.

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## 1. Introduction

The story of computing can be traced back from the Babylonians counting boards to today's modern computers. Over the years, we have heard or experienced the rise in the development of technology from the big computing machines to mini digital computers as well as smartphones we are using in the 21st century. The development has changed the way we live, and everything has been adapted to suit the digital world. For instance, the banking system has been completely overhauled to use computers in daily operations. The education sector in some areas has been shifted to operate on the digital platform. With the current pandemic, the world has come to appreciate the role of computing in education, all courtesy of the historical development of computing.

## 2. Background information

Malawi is a landlocked country covering an area of 118,484 km². It is located in the southern part of Africa, bordered by three countries: Zambia in the northwest, Tanzania northeast, and Mozambique southwest and southeast (see figure 1). It is one of the developing countries in sub-Saharan Africa and is an agricultural based country whose ninety per cent of its economy largely depends on agriculture. As of 2018, the country's population was 17 563,749 (National Statistical Office, 2019). Eighty per cent of the country's population is in rural areas, and most of them rely on agriculture to earn a living.


Figure 1: Map of Malawi (Source: Nations Online)

On education, Malawi education system is made up of pre-primary (ages 3-5), primary (Standards 1-8 and ages 6-13), secondary (Forms 1-4 and ages 14-17) and four years tertiary (ages 18-22) education. Eight years of primary schooling are compulsory. The academic year starts in September and ends in July. The language of instruction for Standards 1 to 4 is Chichewa and standard 5 onwards it is English.

Malawi is one of the countries with the lowest electricity access globally. Currently, only 11 per cent of households are connected to the power grid, with severe disparities between urban (42 per cent) and rural areas (4 per cent). The rich and poor inequity is stark—the poorest 20 per cent reports 1 per cent, and the richest 20 per cent reports 31 per cent electrification rate, World Bank (2020). However, the number of the mobile subscription is at sixty per cent of the

population, which has dramatically increased since the mobile network system was installed in 1998. There are only two mobile service providers in Malawi, namely Airtel Malawi and Telecoms Networks Malawi. According to Malawi Communications Regulatory Authority (MACRA) 2020 report, a total of 8,300,000 and 3,500,000 subscribers have subscribed to Airtel Malawi and Telecom Network Malawi, respectively, as of 2019. MACRA is a statutory cooperation that provides licenses to media houses and communication companies in the country.

Mobile service providers have primarily contributed to computing services to support education from primary, secondary schools and universities. Mobile devices play a crucial role in promoting teaching and learning in universities and schools. The ease in access to knowledge is no more rigid regarding learners' and teachers' reliance on their portable devices to podcast daily duties, consult the news, update their knowledge-based skills (Yala & Keskes, 2020).

This study aims to establish the historical development of computing in universities and schools in Malawi. Our study will disclose how computing entered into the education system, identify the people or organisations who came with the idea of introducing computers into universities, and the purpose behind this development. We will discover how teaching and administrative staff learned to use computers and determine the first computer science course introduced into universities and schools' curriculum.

## 3. Literature review

We live in an information age where we regard information as a primary resource that drives our social well-being and the economy. The information has influenced the creation of an information society whose survival depends on processed information flow. The so-called information society has strived for over a hundred years to reach where it is today. Mahoney (1988) observed that since World War II, "information" has emerged as a fundamental scientific and technological concept applied to phenomena ranging from black holes to DNA, from the organisation of cells to the processes of human thought, and from the management of corporations to the allocation of global resources. Different studies on information processing have been conducted and have noted that the computer has played a valuable role in processing and communicating information for decades in different sectors, including education.

The integration of computing in education has been around 4,500 years ago when the abacus was used for calculating numbers in mathematics. The abacus has potentially influenced

the invention of computers for solving numerical problems. According to Boyanov (2003), in 1930, Atanasoff invented the first electronic digital computer at Iowa State College. Nevertheless, the first digital computers were typically designed for numerical calculations, and they were later improved to be used for a wide range of industrial, administrative, and scientific applications. On the other hand, computer-assisted instruction (CAI), were reported during the late 1960s. In 1967 Kuhn and Allvin experimented with the use of Computer-Aided Instruction in teaching music. Their trials verified the system's feasibility in which students reported increased pitch awareness, and there was dynamic student-machine interaction.

Molnar (1997) also has his findings on the history of computing in education. Molnar found out that computing began at Harvard University and the University of Pennsylvania in 1944 and 1946 using MARK 1 and ENIAC Computers, respectively (see figure 2 and 3). Similarly, these computers were primarily found in mathematics, science, and engineering as a mathematical problem-solving tool, replacing the slide rule and permitting students to deal more directly with problems of a type and size encountered in the real world. In 1947, Howard Aiken began to offer computer courses at Harvard University. His courses centred primarily on numerical applications with programming, and the computer was more of a calculation tool along with the calculator. For many users, this was a fairly logical extension of the instructions laid out for human computers to follow. Generally, female workers spent their days doing calculations to solve problems using tabular instruction sets prescribed by researchers or engineers (Lee, 2006). The National Council of Teachers in Mathematics (2000) agrees that technology is essential in teaching and learning mathematics; it influences the mathematics taught and enhances students' learning."

Figure 2: Mark 1 designed by Howard Hathaway Aiken at Harvard University (Source: Encyclopaedia Britannica website)

Figure 3: ENIAC used at the University of Pennsylvania (Source: University of Pennsylvania website)

Although Molnar states that the use of computers in education started in 1944, Davey and Tatnall (2014) have a different view on the discovery of computer courses in computing history. They claim that Australia was ahead in establishing computer courses in technical colleges. From about 1935, several courses were offered in Victorian Technical Colleges in Australia and punched-card were used to operate accounting and tabulating machines. These courses were very much business-oriented in outlook and, whilst not what we would now call computing courses, did lay some groundwork for future courses in business computing.

In general, most of the literature describes that computers were only used in science-related fields such as mathematics and engineering in the early days in Europe, America and Australia.

The existence of computing in Africa started in the 1920s during the colonial governments. South Africa seems to have been well advanced in terms of computing among all African countries. Most of these computers were used in government departments. Myboradband Tech Magazine (2015) says, “South Africa has a rich computing history, with some of the first machines in the country dating back to 1921 when tabulating equipment from the Computing-Tabulating-Recording Company – IBM’s predecessor –was used in the country’s census”. In the same vein, Rhodes University was the first university in South Africa to install a computer - an ICT 1301 in November 1965. The computer was used to calculate “Ray Tracing for Initial Values as Follow”. Figure 3 shows the ICT 1301, which was at Rhodes University.

Figure 4: ICT 1301. First computer at Rhodes University
(Source MyBroadband Magazine)

In Mozambique, the Eduardo Mondlane University played a crucial role in introducing computing in the country. In the 1980s, the university introduced the computer engineering course in the Faculty of Engineering. The university also launched courses on basic computer skills for teachers, students and civil servants in general in 1993. Furthermore, the university began serving as an Internet provider for public institutions and provided email for the academic community and non-academic staff. In the 2000s, with curricular reform, the

university further installed computer rooms in some faculties and promoted their use in teaching and learning (Muinga, 2019).

Similarly, the University of Malawi (UNIMA) was also moving forward in computing. In 1980 the Department of Computer Science was established in the Faculty of Science at Chancellor College, a constituent college of UNIMA, as a Section under the Mathematics department. In the 90s, the department collaborated with some UK institutions such as the University of Abertay, Dundee, IDPM, Manchester through the British Council Link Program. In another development, Kankuzi (2008) discovered that the early 1990s saw the birth of email services in Malawi. It was in the Physics Department through the UNIMA E-Net project under the leadership of Dr Paulos Nyirenda. The UNIMA E-Net project provided email services using FidoNet technology because, at that time around, the Internet was not yet introduced in Malawi. Kankuzi adds that "the UNIMA E-Net project provided email and internet services not only to the Chancellor College campus but also to surrounding areas in Zomba (see figure 5). Services within the Chancellor College campus were mainly provided through a Local Area Network (LAN). Surrounding areas accessed UNIMA E-Net services through dial-ups over phone lines. Having worked at the UNIMA E-Net project in the later years of its inception, I can still remember how it was becoming difficult to satisfy the demand for Internet services at Chancellor College and indeed to other surrounding areas of Zomba." It is also at the same institution where computers were the first to be introduced in the library department. The purpose of the initiative was to automate library services.

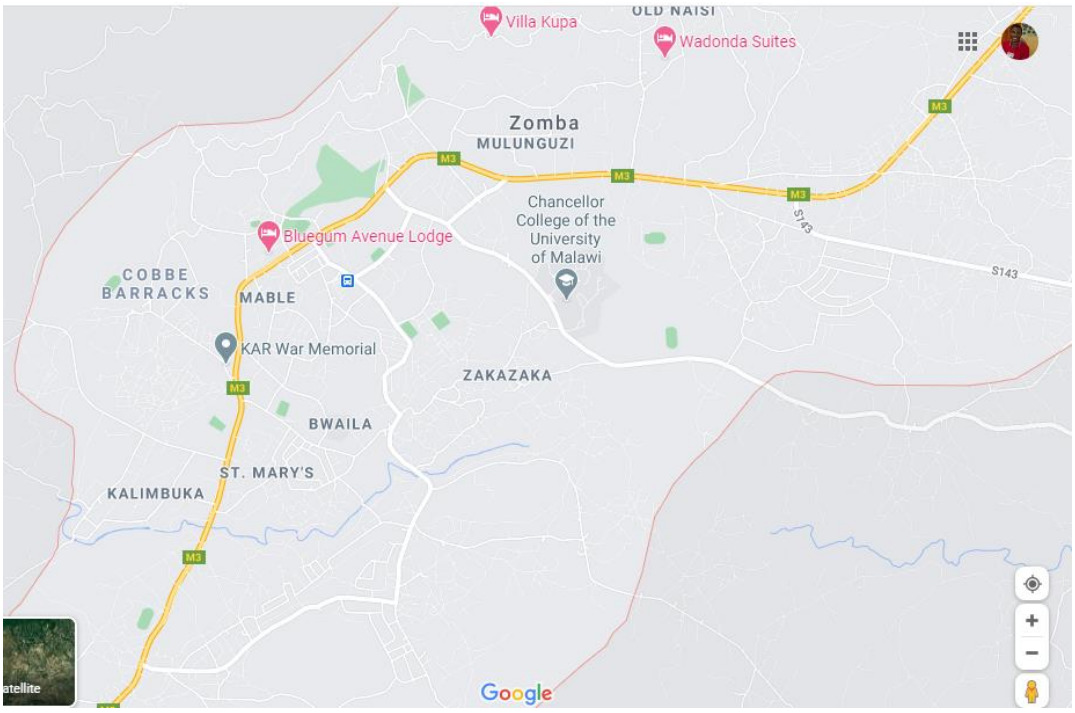


Figure 5: Map of Zomba showing Chancellor College and surrounding areas (Source: Google Map)

Furthermore, Malawi has an Information and Communication Technology association known as the Information and Communication Technology Association of Malawi (ICTAM). "The association is an umbrella body of all ICT professionals in Malawi whose mission is to offer ICT leadership by catalysing policy changes and by supporting related developments aimed at enabling Malawians to participate effectively in the modern technology-based global economy, benefiting the Nation and its partners" (ICTAM website, 2021). The association aims to promote knowledge and understanding of information technology among members, individuals, institutions, and the general public for effective and productive utilisation of ICTs in Malawi and provide forums for exchanging views among information technology professionals and users. On the training part, the association is there to promote the growth and betterment of the ICT community by facilitating education, training, business clustering, partnering, and mentoring, including developing a global awareness of the Malawian ICT community export development.

Botswana is also among the countries that have advocated for the assimilation of computing into education. Hamaluba (2021) reveals that the Revised Nation Policy on Education of 1994 and the National Policy on Education of 1993 advocated for the inclusion of Computer literacy in the Botswana education system. The Botswana national curriculum aimed to incorporate ICT across various schools, starting from primary to junior secondary levels. From 1994 the curriculum provides computer awareness at the junior secondary level and computer studies to the secondary level.

Webuyele in Kamau (2014) concurs that the computer revolution in Kenyan classrooms dates back to the early 1980s when the Ministry of Education Science and Technology decided to allow some experimentation in computer education through a pilot project. He, however, observed that during that time, computers were mostly used in private schools. As time passed, computing advanced in schools, but since then, the growth of ICTs in Kenyan schools has been slow and scattered.

Historically, more has been discussed in the literature about computers in universities and schools from early development to the present. From the time the universities and schools started using computers, they have positively impacted a classroom environment and enhanced virtual learning and teaching. More research has been conducted to evaluate the positive effects of technology on learning and has investigated the kind of enhanced learning environment technology provides in the classroom. In short, considerable resources have been invested in

justifying the place of technology in education, and many research studies have revealed the benefits and skills students, teachers, and administrators have achieved (Jhurree, 2005).

The studies have also indicated that ICT promotes collaboration among students for effective learning and applying their knowledge. ICTs are used to creating new collaborative learning tools and having free and open access to worldwide information. Baran (2014) states that the literature on mobile learning and teacher education generally considered mobile learning a beneficial approach in extending teachers' learning experiences and enhancing their mobile technology integration skills.

In Africa, universities are leading in the development of incubating ICT in their academic system. However, the literature has shown that its impact can only be achieved if governments put policies that would guide and support ICT in education. In Kenya, they have taken broad strategies to enable academic institutions to adopt computing to provide education to all. The policy encourages universities to scale up education and incubate ICT solutions, including partnerships with the business sector (Ministry of Information Communications and Technology, 2016). Universities should take a principal role in offering training to the staff and students on using the technologies.

Secondary and primary schools in Africa are struggling to integrate computing into education. Some governments have developed the curriculum to include computer studies as a subject, but most students do not study the subject. According to the 2019/20 Education Sector Performance Report (2020), the uptake of Computer Studies in schools is significantly lower compared to other mainstream subjects in Malawi. The speculated reasons are that there might be a students' aversion towards these subjects or insufficient teaching aids for the subject, including teachers' capacity to handle and deliver the lessons due to adequate training. This scenario has negative implications in terms of the future country's information technology (IT) prospects. The report continues that "Out of the total secondary school students' enrolment across the country, 37,425 students enrolled in the subject, almost evenly split between male and female students. Raman et al. (2015) also justify that computer science (CS) and its enabling technologies are at the heart of this information age, yet its adoption as a core subject by senior secondary students in Indian schools is low and has not reached critical mass.

On the other hand, introducing ICT in schools should not only focus on taking it as a subject but also a skill that could be imparted in the learners. It is in line with the Indian government decision through the Ministry of Education and the Department of Electronics, which in 1985 jointly launched the Computer-Aided Literacy and Studies in Schools (CLASS)

project. The project aimed at initiating a CS-based curriculum and teachers' training program (Banerjee, 1996). Recognising the imminent need to bridge the digital divide among students of various sections of the society, the MHRD launched the ICT scheme in 2004".

Resistance to embrace computing in education is widespread in most developing countries and hinders computing penetration in universities and schools. The state has a role in promoting ICT diffusion in academic institutions by developing ICT policies tailored for education and providing the necessary resources to establish formal and informal training, which will motivate people to use technologies. In Kenya, there have been some strides in promoting computing in schools. Omwenga in Ciugu (2012) discovered that the most notable government initiative that could be categorised as designed to change society's outlook towards computers overhauled the education system to include more computer and telecommunications studies at primary and secondary levels as well as at tertiary. The Kenya ICT Board (2012) also observed that the most famous initiative was the Wezesha Campaign, through which the government subsidised the purchase of laptops as long those buying were registered students. Such initiatives were geared towards empowering and educating the populace to embrace ICT.

## 4. Aim of the study

The aim of the study is to find out the historical development of computing in universities, schools, and other education-related institutions in Malawi. The thesis will explore the time when computers were introduced in academic institutions and the force behind this development. The study will reveal the key proponents of the incubation of computing about its impact on education in the country.

## 5. Statement of the problem

Computing has a paramount role in improving the quality and access to education. The development of computing in Malawi has been going at a slow pace, and it took a long time for the universities and schools to incorporate or use computing in teaching and learning and for administrative purposes in academics. The hypothesis is that although they have been some promising progress in computing, in the real sense, the development was and is slowly due to several factors such as political commitment, resistance to change, poverty, and lack of necessary skills. The propositions suggest that the dawn of democracy in 1994 became a catalyst for computing in Malawi, though not at an impressive rate as expected.

## 6. Research questions

The study will answer the following questions:

- When did the computers enter universities and schools?
- What factors influenced the diffusion of computing in universities and schools?
- Who were the proponents in the development of computing in education?
- What was and presently is the role of the state in the development of computing in educational institutions?
- What interventions has the ICT Association put in place to promote ICT in education since its inception?

## 7. Objectives of the study

The objectives of the study are to discover the:

- period computers entered universities and schools
- factors influenced the diffusion of computing in universities and schools
- proponents who contributed to the development of computing in education
- role of the state in the development of computing in academic institutions
- intervention of the ICT Association of Malawi

## 8. Significance of the study

The study will help provide the foundation about the birth of computing in Malawi, specifically in education that would help develop a different strategy in developing advanced computing policies and infrastructure to promote ICT in education.

## 9. Conclusion

We have come a long way in computing to reach where we are today. The literature has shown us some historical development in computing and how it has formed computing foundations in education. The history of computing will provide necessary information that could be used in the current development and improvement of ICT creation in universities and schools.

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