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*Zephyrinus Okonkwo*

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Editor in Chief
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GLOBALIZATION OF HEALTHCARE SERVICES, ISSUES, PRACTICES, AND CHALLENGES TO THE NIGERIAN SOCIETY

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Abstract

Forces for change in healthcare can be attributed to its complexity, cost, access, and affordability. These factors are affected by demography, economics, culture, and politics. Many developing countries utilize a variety of innovative alternatives of consumerism to provide health care for their population, and for export. These approaches are evidence-based, and have helped in improving their economy through information technology and medical tourism. Nigeria has identical characteristics and demography with some of the medical tourist nations. However, factors such as politicking, diabolical materialism, lack of funding for research, and development, power outages, policy clarity, planning, and management have combined to derail health care policies in Nigeria.

Key Words: Healthcare, globalization, developing nations, information technology, medical tourism, costs, access, affordability, provider, and consumerism.

Introduction

In today’s competitive, quality driven, and cost-constrained health care environment, healthcare organizations are placing emphasis on the quality of care and effective utilization of resources. Costs, effective technology, and positive outcomes to the provision of healthcare delivery system have become more challenging than ever before. The rise in healthcare consumerism has led health care organizations to embark on technological restructuring and competitive alternatives. The industry has assumed transformational changes on ways of rendering medical treatments and health care services through enhanced information technology, (IT) and data exchange trends. This new trend in technology has transcended into capitalizing on centers of technology excellence around the world as a means to achieving access, and affordability of quality care at low cost. The (IT), and data exchange trends have transformed healthcare services to a tradable product, and less expensive cross-border transactions (Moe, Pappas, & Murray, 2007). In most developed nations, such as the United States of America (USA) and Britain, the healthcare costs are rising faster than inflation (Fuhrman, 2007; Erickson, 2004). In 2009-2010 the healthcare costs rose by 3.3% while inflation rose by 1.6% (Appleby, 2012).

The high costs of delivery have resulted in the challenges of access, choice, affordability, and quality. The deteriorating payer mix, and spiral medical costs help to fuel, and exacerbate the forces of these shifting variables. As costs continue to rise for various reasons such as shortages of nurses, different levels of government regulations and malpractice insurance among many others, a paradox in cost, and in quality become apparent. Consequently, the industry reversed course, and embarked on forming alliances with providers that offer the most services at the best prices. Many of these alliances are outside the USA boundary. Geographical distances and national boundaries become irrelevant and silent partners. As a result of the imperfections in the marketplace, some of the leaders in the industry became wary of the market competition. They are not certain of demand and supply mechanism in a highly regulated industry would be
the only market solution needed to refine, and develop health care programs. Thus healthcare leaders opted to adapting innovative alternatives of delivering services to a broader population. The organizations have to adapt forms of consolidation and diversification to counter marketplace competition in an imperfect marketplace. Generally, most organizational initiatives are structurally strategic, and they include such things as improving access, expanding market share, and improving quality of care. Successful organizations capitalize on leadership abilities and embark on moving their movable services to low cost high quality areas such as India, Singapore, Thailand, Philippines, and others (World Health Organization, 2010). Thus, to maintain affordable but quality services, in healthcare delivery services, outsourcing, and globalization emerged as a policy alternatives (Bernal, 2007). Information technology, telemedicine, e-health, global travel, immigration policies, and the current geopolitical dynamics have substantial and evolutionary effects on how healthcare are provided, and distributed. Health care providers are competing to attract patients who could choose from different providers. Rapid technology has transformed health care systems, and the industry is undergoing dynamic state of evolution with numerous current technologies possessing the ability to effect, change, refine, and in many cases define the future structure, design, and operation of healthcare delivery systems.

**Statements of the Problem**

The emerging phenomenon of outsourcing healthcare services to other poorer countries has revolutionized the industry. The outsourcing is to countries with low labor costs and costs of doing business more affordable or to other parts of the world with an operational competitive advantage. This has resulted in globalization of healthcare. Healthcare leaders are using this new economic reality as a strategic policy model in controlling costs and balancing their budgets (Suszkowski, 2005). The evolution of this trend has trimmed the industries’ business operational costs, increased revenue, provided financial stability, and balanced their budgets (Baker, 2010). Globalization has increased the profitability potentials of the health care services while creating opportunities for the less developed nations (Bernal, 2007). Thus economic, and profit motives underscore the globalization of health. The debilitating financial pressures on health care industries in the USA, and other developed nations have become the driving forces behind globalization of healthcare industries (Martens, Akin, Maud & Moshin, 2010). Vendors of information technology capitalize on operation and process efficiencies to push the boundaries of what can be done in remote locations. Suffice it to say that globalization is pushing the territorial boundaries of nations. Consequently, many participating countries enter into bilateral agreements to resolve some of the potential regulatory conflicts or ethical concerns that may arise. This operational trend and bilateral relationships foster foreign investments, trade, increase in economic activities, and encourage comparative advantages of the participating nations (Dollar, 2001). The author described the benefits of medical tourism. Many developing nations are reaping many benefits through this emerging new business. In 2005, it is estimated that about 150,000 medical tourists went to India for various treatments such as orthopedics, joint replacement, holistic health care, physical therapy, and many others (Dollar, 2001). Philippines, Brazil, China, Poland, Thailand, and others are also benefiting from the healthcare outsourcing. Most often the sourcing flows from the nature of an operation to the available market. Nigeria as a nation has an estimated population of 140 million (Pennington, 2007). However, in Nigeria, the fragmented healthcare models, consistently inconsistent healthcare policies, have hindered the efficiency and administration of healthcare services and policies (Fried & Gaydos, 2002). Nigeria’s lack of comprehensive and clearly developed healthcare systems and infrastructures have made it impossible for the country to neither has the understanding of the basic healthcare needs of the population nor has the leadership competence to develop a sustainable and viable healthcare system (Eboh, n. d.). Navarro (1999) citing World Health Organization (2007) stated “countries and industries who resist globalization would find themselves marginalized in the world community, and in the world health care services.” Globalization of health care industry has become a contemporary source of
medical treatment innovations, investments in health services, increase in employment opportunities, information technology, telemedicine, expansion of economic activities and profits maximization. It is on this backdrop that this research paper on the issues, challenges, and opportunities of globalization of healthcare in Nigeria is written, evaluated, and analyzed.

Research Objectives
The purpose of this research is to examine an important concept to learn as we begin to evolve an understanding of the art of globalization, and the fundamental infrastructural resources, and imperatives needed in Nigeria. Nigeria’s monomaniac obsession to oil for economic development, balancing the budget and solving the nations large, and rural population is a risky economic endeavor. The unemployment of skilled professionals is staggering, and the imbalance between the rich and the poor is widening resulting in lack of access, affordable, and quality basic health care. It is argued that expansion of healthcare industry and creation of medical tourism in Nigeria will reduce healthcare costs, improve longevity of life, increase employment, and increase standard of living.

Research Design and Method
To address this issue, we used qualitative research method for the study with the application of questionnaire and oral interviews to encourage full participation of respondents. The study used primary and secondary data. We collected the primary data from Nigerian healthcare practitioners residing in Nigeria and in the USA respectively. We tallied, and analyzed responses using Nvivo 7 soft-ware. These responses from Nigerian healthcare professionals both in Nigeria, and in the USA are semi-structured. The software facilitated sorting, organizing, and identification of the core themes, and patterns as recommended by Creswell (2005). Numerical scores were attached to each theme. Higher numerical score indicates greater problems for globalization of healthcare in Nigeria while lower scores indicates lower problem for globalization. We obtained secondary data from peer reviewed journals retrieved from various institutional libraries such as EBSCO host, Proquest, and other websites.

Research, Analysis, and Discussion
Politics and, Corruption
Analysis from the study showed that forces of political instability aided by incessant breakdown of law and order can be attributed to the absence of globalization of healthcare in Nigeria. These forces exert diabolical pressure collectively while individually intersecting adversely to make the challenges too steep to climb and overcome. As Moszynski, (2006) research noted, fighting corruption in the healthcare system is an arduous, expensive, and a complex challenge. There is a total failure in planning and managing Nigeria’s healthcare system. This failure in most instances is attributed to the nation’s inability, to capitalize on the free fall of information technology, sharing of automated research on telemedicine, e health; e prescription and therapeutic intervention. The abysmal politicking in the development and welfare of the people, and human health has aided, and abated complex cultural and structural systems in the healthcare delivery systems. This has resulted in retrogressive configuration in the healthcare development considered too complex for foreign and global investors. The momentum of selfish interest enabled by geopolitical considerations has created overt and covert conflicts with the ruling political party and the opposition party as well.

Fraud and corruption have resulted in a healthcare system considered as not capable of providing the necessary infrastructures for healthcare systems but also not ready to embrace the needed information technology beyond the Nigerian boundaries. Money lost to corruption in Nigeria could be used for medical equipment, and staffing (Moszynski). There is a culture of unprecedented collaborative dishonesty among the leaders, and the Nigerian population. Hadi (n. d) noted that widespread corruption in healthcare services in addition to large-scale neglect have hindered progress in modernizing Nigerian healthcare services. Thus
Nigerian health system has fallen out of favor for foreign investment. In most developing countries, such as India, Philippine, Singapore, health care marketers are constantly gaining market shares, optimizing operational efficiencies, leveraging on their abilities to speak English language, and maximizing their potentials while applying best practices. However in Nigeria, political corrosiveness has become cancerous, and a hindrance to globalization.

Lack of Basic Infrastructure, and Human Capital

Baker, (2010) ; Fuhrmans, (2007) indicated that healthcare services in Nigeria lacked basic modern infrastructure, investment on human capital and professional training needed in the 21st century. Primary research was consistent with review of literature. Evidence-based medicine, virtual healthcare teams are neither practiced nor articulated as modern alternate procedures. Primary research showed that healthcare facilities in Nigeria lack the necessary infrastructure needed to operate modern and decent hospitals. Most of the facilities operate without basic items such as surgical equipment, needles, syringes, drugs, and basic necessities such as water, and power supply. Furthermore, research participants agreed that teaching hospitals and specialist hospitals such as orthopedic, eye, psychiatric, maternity, and pediatrics facilities are at rudimentary and “out of model” technology. These findings were supported by (Uneke, 2009; Okolo, 2010). Other studies (Nigeria Health, 2010; Pennington, 2007) showed that for the government to operate healthcare services, it must appropriate substantial amount of capital to provide structures, equipment, training, other allied services, and resources. The prevalence of segmented and tertiary healthcare systems made it almost impossible to have a comprehensive healthcare system. Thus it presents a complicated, and confusing healthcare policy, and reimbursement procedures. The present healthcare product lacks facilities, and equipment for diagnostic, and procedural evaluations. There are neither resources for recording diagnostic procedures nor necessary information technology for medical information retrieval. Accountability and responsibility are non-existent.

In Nigeria, telemedicine is an unknown technological initiative. Emergency facilities, such as ambulance services and emergency room doctors are also nonexistent (Okolo, 2010; Ogunrin, et. al, 2010). In a country where tertiary system is the prevalent system with many of the population living in remote areas, telemedicine is supposedly the best alternative in reaching out to the indigent and rural population. However, telemedicine is an unknown system, and procedure. Also this new medical technology cannot function in a system with unreliable power supply, and constant power outages (Raufu, 2002). The number of healthcare centers in Nigeria is about 700 and 1670 maternity centers (Nigeria Health, 2010). In 2000, it was estimated that there were 2 physicians and 1.7 hospitals beds per 1,000 people (p. 1). Supporting the argument are Fried and Gaydos (2002) citing Kiragu, Chapman, and Lewis (1995). The authors stated that Nigeria had 0.2 physicians per 1,000 populations, and 142 nurses per 100,000 populations.

One of the most rapidly growing areas in healthcare delivery is e-Health. The service comprise of extensive use of information technology, communication, and data processing. It involves the use of information technology, and communication to advance, and improve patient care especially in the remote areas of the country. Others are e-prescription; remote patient monitoring, and e-Medical records-EMR (e Health and Telemedicine in Nigeria, 2008). E Health system can only work well in a country with steady supply of electricity or power energy. Infrequent power supply and constant outages in Nigeria have made it impossible to conceive a system as sophisticated and as efficient as e Health. Uneke et al. (2008) stated that the quality, and skills needed to combat different types of diseases, and illness are nonexistent. Blood bank services, and availability of antibiotics necessary in the management of most gynecological emergencies are absent in most of the rural and urban hospitals (Buowari, 2010).The system lacks professional development, and training.
Funding, Research and Development

Researcher Buowari (2010) indicated that 85% of Nigerians agree that research and development are vital to the development and improvement of Nigerian healthcare system. The current system in Nigeria faces a number of challenges, including under-investment, research, and development. Additional studies Laucef, (2005); Obioma, (2007); Raufu, (2002) contended that there is a total collapse of the healthcare research in Nigeria. Furthermore, teaching hospitals, and research facilities designed for research services have either lost most of their competent researchers or have no capital budget to conduct a meaningful research project. The absence of funding, and skilled personnel has crippled enhanced development in modern technology, and procedures. The total health expenditure as a percentage of gross domestic product GDP from 1998 – 2000 was less than 5% falling below the GDP ratio in other developing countries such as Kenya (5.3%), Zambia (6.2%) Tanzania (6.8%), Malawi (7.2%) and South Africa (7.5%) and in 2007, the federal budgetary component of health expenditure increased to 7.2% (Olakunde, 2012). The level of government expenditure fosters the use of obsolete surgical procedures, and equipment. There is inadequate funding for research, and development. Most research centers or institutes have no research specialists for important disciplines, and it is not uncommon for those available to perform regularly out of specialized discipline areas. Research in biomedicine and in other allied healthcare are non-existent, thus prompting Uneke (2009) to remind the nation the importance of research and development in strengthening the nation’s healthcare, and in staying in compliance with processes and procedures of delivering health services, and the promotion of health procedures in Nigeria. Scholars such as Uneke (2009) stressed that research and development is imminent in deciding, and determining the quality, and procedures for delivering health services in Nigeria. Successful healthcare globalization or medical tourism in Nigeria, involves adequate funding, and budget allocation. However, this important element is abysmally low, and this will continue to be a challenge to the Nigerian government, and potential investors.

Funding tertiary care is the responsibility of the federal government, the state governments fund secondary care, and the local governments are responsible for primary care. However, as a result of incoherent policies, and lack of adequate funding from levels of governments, their responsibilities often overlap each other without a financial trade-off of responsibility, and leadership accountability (College of Medicine, University of Ibadan, 2009).

Problems of Medical Colleges, Specialties, and Professional Migration

The research unveiled status level of mediocrity of most Nigerian medical colleges. Most of the medical colleges in the country lack the necessary modern laboratory, technological equipment, clinical hospitals, and qualified teaching faculty. Many colleges still harbor dilapidated research centers, obsolete laboratories, archaic medical equipment, unqualified faculty members, and ill-trained support staff. The medical colleges are not streamlined, and are out of balance with the nation’s needs. Specialties are not diversified, and there is no effort made in attracting the skilled professors, and professionals for those specialties. Respondents from primary research commented that non-diversification of medical specialties is a national emergency, and an embarrassment to the health care system of the country. There is acute shortage of specialties in many areas such as ophthalmology, oncology, neurology, gynecology, and many other surgical and specialty disciplines. This is a serious medical danger because an overwhelming majority of medical doctors in the country are primary healthcare physicians. As a nation we cannot underestimate the potential hazard this poses to the health care delivery system because it is an aberration. Developing nations aspiring to join the League of Nations in medical tourism or globalization of healthcare expect evidence-based outcomes. The absence of licensing regulations has given rise to mushrooming of inadequately equipped and manned, often one- man doctor private hospitals, and diagnostics outfit such as radiography, laboratory, and others. Most of these outposts have providers that are not licensed to perform their functions. Diagnosis and procedures are analyzed by unskilled providers. These diagnosis centers are incapable of passing any international credentialing requirement.
Poor Benefits and Compensation

Studies conducted by (Bernal, 2007; Okolo, 2010) indicated that poor benefits, and compensations are central to mass exodus of qualified Nigerian medical practitioners out of the country. Primary data indicated that doctors in Nigeria earn far less than they would earn working in the U.S, Europe, India, and Middle East. This result collaborated with the studies by (Fried & Gaydos, 2002; Raufu, 2002). Vanguard (2011) reported the frustrations of Abia state medical doctors on non-payment of salaries and allowances as agreed in their contracts. Raufu (2002) was concerned about the exodus of health practitioners to overseas countries. He enumerated that better pay and fringe benefits are the main reasons for the migration of Nigerian doctors, nurses, and paramedical staff. Ogunrin, Ogunrin, and Akerele (2011) argued that the needs for better pay and other fringe benefits must be satisfied to enable doctors meet their service obligations, and satisfy or meet their regular psychological needs. Migration of healthcare professionals out of Nigeria has created shortages, hardships, and “near-misses” in health care services. It has also exacerbated weaknesses in already strained and impoverished healthcare delivery systems (Ogilvie, et al, 2007). The fundamental prerequisite for any functioning system is its professional workforce (Lancet, 2005). The shortages created by the exodus gave rise to a diminutive growth in our healthcare delivery structure and a debilitating effect on the growth and development of the social welfare of the nation. Furthermore, the shortages have devastated the human resources, and capital infrastructure necessary for the development, and improvement of the economy, and human capital. Obioma (2007) stated that the past two decades have witnessed intensification of globalization and unprecedented exodus of African professionals to developed countries. Raufu (2002, p. 1) citing Ekpendu cited that “exodus of nurses from Nigeria to abroad will not stop until the government addresses the issue of poor salary and the decay of health care sector.” Furthermore, the data also revealed that poor working conditions, environmental issues, and hostilities were factors in the mass exodus of Nigerian medical practitioners out of Nigeria. This finding is consistent with the literature by Uneke, Ogbonna, Ezeoha, Oyibo, Onwe, and Ngwu (2008)

Competition

The data revealed that healthcare in Nigerian is not competitive. The Nigerian government monopolizes the industry thereby rendering the system non-competitive. The non-competitiveness of this service stifles service delivery, innovation, and essential customer service. As a result of monopolistic practices, leaderships are appointed by politicians. These appointees are not by merit but by political patronage or geo-political considerations. As a result, non-medical practitioners are left to make most of the medical decisions. In most instances, this results to unpleasant consequences. In developed and developing nations such as India and Philippines, where medical tourism thrives, healthcare organizations are competitive. Competition in healthcare leads to new approaches to delivering care. It leads to improvements in quality, and reduction in costs. However in Nigeria, complex, and incoherent healthcare system dominates the healthcare delivery. This complex system oscillates from primary to secondary, and tertiary. The system is bureaucratic, and is administered by three levels of governments - the federal, state, and local governments. There is a confusing clarity in the model, and the modern healthcare information technology has a tendency to rebuff such complex system.

Conclusion and Recommendations

Globalization of healthcare or “medical tourism” encompasses complex international interconnectedness in diagnosing, evaluating, treatment of diseases, illness, and healthcare delivery systems. It involves effective interactions among the multiple stakeholders such as the providers of care, the patients, the international community, the vendors of health supplies, and many others. Fineberg and Hunter (2013) described globalization as the goal of improving healthcare delivery services for all people in all
participating nations by improving, and eliminating preventable diseases, disabilities, and deaths. This concept is only possible across the sovereign boundaries and in between nations. Quality healthcare service cannot be delivered in a silo. Procedures, innovations, breakthroughs, challenges have to be open, transparent, modern, and evidence based. The new global and financial economy does not have boundaries, and limitations. Scholars and analysts have embraced this concept to extend beyond the territorial boundaries of nations.

In this paper, the authors recommend a new model of thought that deviates from Nigeria’s traditional and obsolete procedures of delivery healthcare. They recommend a modern healthcare system attractive to modern investors. Nigeria as an English speaking nation is a fertile ground for the USA and the Great Britain healthcare investors. Nigeria has an advantage over many developing nations that thrives in medical tourism. Possessing a large market of 140 million populations with well educated population base, the country is demographically positioned to benefit from medical tourism (Pennington, 2007). However, to benefit from this, the country needs to be perceived to be competent in all phases of the organizational management, planning, development, political stability, and corrupt free society. This emerging global concept, and initiative could be used in Nigeria’s healthcare delivery systems, such as is the case in countries like India, Singapore, Thailand, and Philippines. Nigeria could leverage her large market resources, and potential skilled labor pool in maximizing this emerging opportunity.

Globalization of healthcare in Nigeria has the potential to encourage, and galvanize massive developments in information technology, power energy, capital infrastructure, and optimization of human skills. The model has the potential to forestall the exodus of Nigerian medical practitioners. It will force the Nigerian government in developing different economic and technological sectors such as information technology, power supply independence, medical technology, medical research laboratories, leadership skills, capital development, and many other areas. It will create economic opportunities in all sectors. Nigerian healthcare system today is inaccessible to the poor, and to the rural population. Thus, globalization will create different types of information technology designed primarily to reach these neglected population. It will create opportunities in development of telemedicine in which medical decisions are made for patients within the country, and outside the country. Some of the recommended telemedicine procedures are e-prescriptions. Prescriptions can be made electronically to remote areas instead of doctor’s handwritten prescription. Others are virtual healthcare teams in which patient care is analyzed, and treated through video conferencing even in remote areas of Nigeria, and any parts of the world. E-Medical records, (EMR) that shares patients’ information, and data electronically to the desired recipient for necessary medical decisions. The telemedicine includes diagnostic analysis such as MRI, X-rays, and other radiological services. As costs of rendering healthcare in developed countries, especially in the United States of America, has soured, many developing countries such as India are Philippines are taking advantage of these new-found market in advancing their healthcare delivery systems, maximizing profits, and rendering quality, affordable services. Such innovative strides directly have advanced their health care delivery systems to almost an enviable status. Nigeria can emulate these countries in their medical and technological innovations. Globalization will create healthy competition the epicenter for development. This model could increase foreign investments in Nigeria’s healthcare infrastructure, and capital development. Globalization when properly planned and implemented has the potential of reversing the exodus trend of medical practitioners because many skilled medical doctors, nurses, pharmacies, paramedics in diasporas may seek to return to these new facilities with modern medical infrastructure, medical research resources, and information technology. They could return to take advantage of the telemedicine, the potential benefits in treatments, and capital resources. Successful nations will capitalize on e-health applications, and medical tourism in meeting, and exceeding national healthcare objectives, balance of trade, foreign reserves, economic development as well as consumer expectations. The effective use of the Internet is a strategic initiative that has significant implications for national survival. Nations involved in medical tourism recognize, and understand the capacity to web-enable functions, and importance in developing infrastructures conducive
for healthcare globalization. National leaders must assume a visionary view, and understanding of healthcare, and should be willing to challenge the status quo: failure to do so will leave the nation behind the curve.

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AN EXAMINATION OF THE STUDY TABLE PROJECT AND STUDENT ACHIEVEMENT AT A FOUR-YEAR COLLEGE: RAMIFICATIONS FOR RETENTION, PROGRESSION AND GRADUATION

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ABSTRACT

Traditionally, XYZ University had employed a multifaceted approach to provide students out-of-class academic learning support which focused on enhancing student academic achievement, retention, progression, persistence, and graduation in their courses and programs. Over the years, retention, persistence, and graduation (RPG) have become essential attributes for gauging institutional effectiveness in the University System to which XYZ University belongs. State funding of state Colleges and Universities are partially based on these delineated attributes. Support programs included peer tutoring in a variety of courses, sometimes housed in various academic units and departments, with supplemental instruction, mostly facilitated by instructors. Supplemental Instruction (SI) targeted gatekeeper courses such as College Algebra, Precalculus with Trigonometry, Calculus I, General Chemistry I, Introduction to Biology I, and Introductory Physics I. These courses have traditionally had very high Fail, “D grade, and withdrawal (FDW). In order to improve student success rate in foundation teacher certification exams, Praxis I (Pre-Professional Skills Tests) review, encompassing of the quantitative and verbal sections, was introduced, this was later replaced by a state mandated Assessments for the Certification of Educators review. These academic support programs have achieved a reasonable level of success in the past, although no comprehensive assessment report has been written regarding overall accomplishments of these interventions. Guided by the zeal to continue to improve student retention, progression, and graduation at XYZ University, the Study Table Project was introduced in fall of 2011. The Study Table provides all students an opportunity to improve their performances in a formal, congenial, non-threatening, guided learning environment not only in the gate-keeper courses but also in many other courses which have been identified as challenging to many students. Students are able to participate in group tutoring, one-on-one problem solving sessions, homework help, and effective increase in quality time-on-task, and even help in technology applications facilitated by peer tutors and instructors at one center. Hence, students were able to receive help in one or more courses during one session. This paper examines the impact of the Study Table Project on student achievement during the 2011-2012 academic year. In this paper therefore, we compare student achievement within two subgroups in each category: participant and non-participant; the categories being freshman, sophomore, junior, senior, athlete, and the learning support cohort. Furthermore, participant survey results were used to gauge participant perception of the impact of the Study Table on their achievement.

Keywords: retention, progression, graduation, gatekeeper courses, study table project, student achievement, supplemental instruction, effective increase in time-on-task, study table project (ST), fail, “D” grade, and “withdrawal (FDW)
1. INTRODUCTION

The Study Table at XYZ University provides one-stop center for all students seeking to improve their performance, achievement, engagement, and hence grades in gate-keeper courses, and other courses which have traditionally had high rate of failing grades, drop, or withdrawal. It has been determined that STEM (Science, Technology, Engineering, and Mathematics) courses such as College Algebra, Precalculus, Calculus, Introductory Chemistry and Biology courses, and accounting, economics, and other business courses which need strong quantitative skills also fall into this category. High FDW rates have been seen to affect adversely overall student performance as exemplified by their GPAs, retention as well as progression in their majors. Students receive help from instructors and peer-tutors in a non-threatening guided environment, and could seek help in one or more courses during a single session. Research indicates that learner’s ability to increase quality time-on-task translates to overall enhanced performance in courses which leads to learner increased self-confidence. The goal of the Study Table Assessment Study is to determine the impact of Study Table project on student learning, student achievement and persistence at XYZ University. This could subsequently result in the improvement of student persistence, retention, progression, and graduation, and would ultimately have broader impact and add value to students’ matriculation at XYZ University. It was expected that at end of the academic year, Study Table participants’ performance will exceed the performance of non-participants. The attribute for this measure is end-of-academic year cumulative GPA.

Many colleges and universities have adopted the Study-Table concept with similar goals: to enhance student achievement through additional guided out-of-class academic help. At the University of Maryland, all first year student athletes must attend Study Table for a minimum of eight hours per week. Student athletes with GPA ≥ 2.3 or more are exempt, but all student athletes with less GPA than required are expected to spend 6 hours to 10 hours per week at Study Table. Ball State University has Study Table focusing on athletes, while Indiana University’s Study Table attendance is required for all first semester freshmen as well as transfer students and anyone with a GPA below 2.5. The totals hours required are determined by the student’s GPA and classification.

SI is research supported. Several published research in the literature have shown that Supplemental Instruction has played a strong role in improved performance of participants and retention efforts at many colleges and universities. In 1973, the University of Missouri Kansas City (UMKC) developed SI to enhance the retention of minority medical students. The success of this SI program encouraged UMKC to extend such services to beginning undergraduate courses, Martin & Hurley (2005). Supplemental Instruction not only improves student performance in the course content, it also enables participants to develop active learning skills and improve their problem-solving skills in later courses (Behrman, Dark, & Paul, 1984, Peters, 1990). Kenney and Kallison (1994) provide some evidence that participation in SI programs can affect course grades, rates of D and F grades and course withdrawals and semester grade-point averages. The US Department of Education (USDOE) has designated the UMKC SI model as an Exemplary Educational Program. USDOE validated SI as the only program which improves academic achievements and graduation rates. An SI program has the potential to pay for itself since students tend to remain at the institutions where they receive academic support and improve their performance. Consequently, income that is generally lost due to attrition is retained by the institution since such students have higher rates of re-enrolment in subsequent semesters.

Research shows that SI raises grades, retention rates, and increases graduation rates by 10% ( Blanc, DeBuhr & Martin, 1983; National Center for Supplemental Instruction, 1997; Congos & Schoeps, 1993; Lundeberg 1990: Wolf, 1987). SI sessions have been found to have positive effect on learning competence, content knowledge competence and academic achievement (Blanc, Debuhr, and Martin, 1983, Ning & Downing, 2010). SI instruction gives students the opportunity to have more exposure to concepts and contents of the course. As students learn the content, they also develop the study skills needed. Students
become more confident in their communication and problem-solving abilities and consequently emerge as autonomous learners. Both the SI process and content are not only intended to help the student achieve better grade in the next test, but also on the final course grade and future courses (Gattis, 1999). Blanc, DeBuhr, and Martin (1983), conducted the first large scale study on the effect of participation in SI using a sample of more than 700 students enrolled in at least one of four courses. Blanc et al compared SI participants with course mates who chose not to attend SI or could not attend SI due to scheduling conflicts. SI participant group had higher course grades and semester GPAs. Tracking these students for additional two semesters showed that SI participants had higher frequency of re-enrollment in college. They concluded that SI is an effective program which can affect students overall achievement in college courses, rate of retention in college, and hence the likelihood of earning a baccalaureate degree (Kenney & Kallison, 1994). Although several articles have appeared in the literature on the efforts made by majority institutions to support minority students through various forms of academic support, very few research results dealing with SI and retention in minority institutions have appeared in the literature.

Using data from 2011 administration of the National Survey of Student Engagement (NSSE), designed to measure student behaviors and time and energy they in activities related to student learning and development, A. Rebera, A. BlrckaLorenz, and T. Ribera (2012) showed that SI participants have higher engagement scores, deep approaches to learning, and self-reported gains. Furthermore, they showed from their studies that 34% of the freshmen said they attended instructor-led SI sessions, 40% of freshmen attended experienced student led SI sessions; 40% of seniors attended instructor led SI sessions while 40% of seniors attended experienced student led SI. Their data was obtained from 39 doctoral universities, 36 Master’s granting universities and 25 Baccalaureate universities.

The Academic Success Center at Oregon State University supports Supplemental Instruction (SI) by engaging various academic departments, faculty, staff and graduate students. In particular, SI was conducted in various gatekeeper mathematics courses. SI sessions were conducted in Mathematics courses such College Algebra, Trigonometry, Calculus I, Calculus II, Calculus III, Business Mathematics, and Business Calculus. The sessions were facilitated by SI leaders: students who have showed reasonable measure of competence in the courses they facilitated, and were equally trained to become competent facilitators. Graduate students participated too. About 21% of students enrolled in the above-mentioned courses attended SI. An examination of student performance in college algebra indicates that the participant subgroup of the borderline College Algebra group outperformed the non-participant subgroup significantly, with the mean GPA of the participant subgroup exceeding the non-participant subgroup by 0.41. Data showed that the SI program was effective in contributing to factors influencing student success, engagement, and persistence at the university. In their findings, external reviewers highlighted the impact of SI and endorsed the efforts to broaden the scope of SI at the university. Reviews affirmed the success of the program and recommended that the program be sustained. The Study Table concept is a laudable extension SI whereby students receive help in several gatekeeper courses at one location: this gives the participant an opportunity to seek help in more than one subject during one session. Furthermore it enables cohort of students to receive group help or complete group work in a congenial environment.

In Section 2 of this paper, we delineate the methodology used for this study. Goals, objectives and outcomes of the study are presented, and data sources as well as methods of data collection are outlined. Furthermore, assumptions of the study are outlined. Section 3 focuses on fall 2011 Study Table Data Description with relevant frequency distributions and associated statistics, with summary notes. In Section 4, we focus on fall 2011 Study Table data analysis and hypothesis testing; essentially, using the test of difference of mean GPA of the subgroups in each category, the participant group and the non-participant group. Section 5 we
examine spring 2012 Study Table *Data Description*, replicating what was done in Section 3 for fall 2011 data, the goal here being to build data patterns. In Section 6, we focus on spring 2012 Study Table data analysis and hypothesis testing, a replication of the form of analysis which was done on fall 2011 data, again crafting data patterns. In Section 7, we examine end of academic year Study Table data analysis and hypothesis testing. In Section 8, we examine the results of previous student academic enrichment and interventions and compare them with the Study Table results, and in Section 9, we present participant survey results. This paper is concluded in Section 10 with relevant suggestions that could enhance positive outcomes of the Study Table Project.

2. METHODOLOGY

In order to craft an effective design of study, it is essential that some research questions are posed, specific objectives of the study stated, and anticipated outcomes of the study delineated. These will guide research design of this study. Here are some broader research questions:

(i) Does Study Table attendance and participation enhance student achievement XYZ University?
(ii) Does Study Table attendance enhance student problem solving abilities?
(iii) Does Study Table attendance increase retention?
(iv) Does Study Table Attendance enhance academic achievement of Learning Support students?
(v) What are the added values Study Table generates at XYZ University?

Study Table participation is open to all XYZ University students including graduate students. It is not a compulsory program. There are no restrictions for participants although some instructors encourage students to attend study table sessions. The following assumptions are essential for this study:

(a) All students come to XYZ University with the same characteristics. Although students come with different interests and motivation, no efforts are made to attract say highly motivated students.
(b) There is no difference in pre-college preparation between the participants’ cohorts and nonparticipant cohorts. Hence, IQ’s and other individual attributes cannot be *cofounding variables*.
(c) No group of students is deprived of participating in the Study Table.
(d) Study Table schedule is made in such a way that every student can attend

The objectives of the Study Table project assessment are as follows:

(i) Compare the achievement of the group of Study Table participants with non-participants
(ii) Determine the achievement of certain cohorts of students as categorized as freshman, sophomore, junior, athlete, and others with non-participants.
(iii) Examine participant interests by administering, collating, and analyzing survey data completed by participants.
(iv) Initiate longitudinal study of freshman and sophomore cohorts which will enable the university to continue to improve their engagement in student learning and student success and subsequently improve their progression and graduation.
(v) Interpret other secondary impacts Study Table activities could have on retention.

Below are the outcomes of the Study Table project assessment:

(i) Participants’ distributions in various categories are presented.
Study Table project subjects itself to multi-faceted data collection methods. The Study Table arena was divided into four sections based on the major disciplined of interest: (a) Mathematics Section, (b) Science Section, (c) Athletes Section, (d) General Supplemental Instruction Section.

During every session of the Study Table, the following data were collected:

**Attendance Records:** All students are expected to swipe their XYZ University identification cards at the kiosk before proceeding to receive the help they need. This enables Study Table supervisors to perform a head count for the day as well as determine the number of students receiving help in each section that day. Participant’s classification, frequency of attendance, the course in which the participant receives help, is recorded accordingly.

**Targeted Courses:** Although students can receive help in various courses, data collection enables the supervisors to determine the courses which attract most students, and this could enable them to reallocate resources based on demand.

**Targeted Cohorts:** Although all students are invited to the Study Table, freshman and sophomore, and athlete cohorts are the most targeted. Research indicates (as will be seen the sequel), that freshman cohort performs very poorly due to lack of focus in early semesters. Hence, most freshmen are at risk due to poor performance in their courses.

**Below are other essential data.**

**Midterm grades:** Midterm grades of all participants as well as nonparticipants were collected. Anecdotal information indicates that some midterm grades are dummy grades and cannot therefore be used to make any quantifiable decisions. However, midterm grade are still useful for advisory reasons and could be used to identify students who are at risk and who can be helped through remediation plans. They are therefore not relevant for this paper.

**End-of-Semester GPA:** End-of-semester GPA of all participants and nonparticipants were collected.

**Participant Survey:** Towards the end of the fall semester, participant survey was conducted collated. The result of that survey is presented as part of this report.

**Data Sources:** In order to collect and collate data necessary for this study, multiple data sources were sought. These sources are:

**Office of Institutional Research:** The Office of Institutional Research reposes all data related to both academic and nonacademic activities at XYZ University. Student enrollment numbers, enrollment numbers in various categories, mean GPA of various categories were obtained from that office.

**Office of Student Retention and Study Table:** Student attendance records, targeted courses, and overall daily and weekly attendance were obtained from this office. This office also makes sure that data related to
student attendance as well as faculty and peer-tutor attendance are collected in a timely manner and inputted in the university database.

**Participant Survey:** The participant survey was administered by the Office of Student Retention and Study Table. The result of the survey was collated. The result of the survey is presented subsequently.

In this paper, we use three corroborating routes of evidence to draw conclusion of the impact of the Study Project on student achievement:

(i) Data description in form of mean GPAs in each of the categories for the participant group and non-participant group;
(ii) Data analysis using inferential statistical tools; in this case we use the test of difference of means.
(iii) Participant survey results which are presented in tabular and graphical form.

### 3. FALL 2011 STUDY TABLE DATA DESCRIPTION

During the fall of 2011, 4663 were enrolled at XYZ University. Every student who enrolled in least in a one-hour course, including noncredit course, is included in this count. We note that 4178 students enrolled as undergraduates, 3846 (82.48%) students enrolled as full-time students, while 817 (17.52%) enrolled as part-time students. Full-time freshman enrollment was 1486 or 94.71% of all freshmen enrolled. The total number of students who received help at Study Table was 1190. Of this number, 754 freshmen received help, a total of 63.36% of Study Table participants. Table 3.1A shows the number of students enrolled in each cohort and associated cohort’s statistics. Note also that 14 students are uncategorized.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>End of Semester Mean GPA</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of undergraduates</td>
<td>4187</td>
<td>2.38</td>
<td>1.072464816</td>
</tr>
<tr>
<td>Freshman</td>
<td>1569</td>
<td>2.15</td>
<td>1.086225114</td>
</tr>
<tr>
<td>Sophomore</td>
<td>800</td>
<td>2.44</td>
<td>1.009603867</td>
</tr>
<tr>
<td>Junior</td>
<td>708</td>
<td>2.50</td>
<td>1.021508938</td>
</tr>
<tr>
<td>Senior</td>
<td>1096</td>
<td>2.60</td>
<td>1.0611677</td>
</tr>
<tr>
<td>Athlete</td>
<td>208</td>
<td>2.16</td>
<td>0.960113565</td>
</tr>
</tbody>
</table>

**Table 3.1A: Fall 2011 Enrollment and Mean GPA from Final Grades**

A student is said to be in good academic standing if that student maintains a GPA of 2.00. A careful examination of the above table indicates the freshman class has a mean GPA of 2.15 with the standard deviation of 1.09. If we assume that GPA is normally distributed about the mean, it shows that about 44% of the freshman class is not in good standing at the end of their first semester.

Table 3.1B presents full-time undergraduate enrollment statistics for fall 2011. From Table 3.1A and 3.1B, it is observed that the mean GPAs and standard deviations of both all students and full-time students in each of the categories are the same. This is because most students are full-time students.
Table 3.IB: Fall 2011 Full-Time Enrollment Statistics

*Learning Support* cohort includes freshman who do not meet CPC (college preparatory credits). This cohort has a critical number of at-risk students. Retention, persistence, and progression of this group of students are essential to the university. Below are essential data related to the learning support cohort.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Average Number of College Credit Hours Completed</th>
<th>End of Semester Mean GPA</th>
<th>End of Semester Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students in Learning Support</td>
<td>191</td>
<td>7</td>
<td>1.93</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.II: Learning support cohort Statistics

Table 3.III is the Study Table participant data. A comparative examination of Table 3.1A and Table 3.III shows that participant subgroup cohort exceeds the population mean in each category significantly.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Average Number of College Credit Hours Completed</th>
<th>End of Semester Mean GPA</th>
<th>End of Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of Undergraduate Students</td>
<td>1186</td>
<td>11</td>
<td>2.44</td>
<td>0.904035753</td>
</tr>
<tr>
<td>Freshman</td>
<td>754</td>
<td>11</td>
<td>2.34</td>
<td>0.940418517</td>
</tr>
<tr>
<td>Sophomore</td>
<td>173</td>
<td>12</td>
<td>2.55</td>
<td>0.8455891202</td>
</tr>
<tr>
<td>Junior</td>
<td>133</td>
<td>12</td>
<td>2.57</td>
<td>0.833871565</td>
</tr>
<tr>
<td>Senior</td>
<td>125</td>
<td>13</td>
<td>2.70</td>
<td>0.738991789</td>
</tr>
<tr>
<td>Athlete</td>
<td>92</td>
<td>13</td>
<td>2.19</td>
<td>0.95</td>
</tr>
<tr>
<td>Students in Learning Support</td>
<td>93</td>
<td>8</td>
<td>2.17</td>
<td>1.065575423</td>
</tr>
</tbody>
</table>

Table 3.III: Study Table Participants Data Fall 2011
Table 3.IV presents aggregated data for each of the categories and their associated subgroups, namely, the participant subgroup and the non-participant subgroup.

<table>
<thead>
<tr>
<th>Category</th>
<th>Participant</th>
<th>Non-Participant</th>
<th>End Semester Mean GPA of Participant</th>
<th>End of Semester Mean GPA of Non Participant</th>
<th>Standard Deviation of Participant</th>
<th>Standard Deviation Non Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>754</td>
<td>815</td>
<td>2.34</td>
<td>1.96</td>
<td>0.94</td>
<td>1.18</td>
</tr>
<tr>
<td>Sophomore</td>
<td>173</td>
<td>627</td>
<td>2.55</td>
<td>2.40</td>
<td>0.85</td>
<td>1.05</td>
</tr>
<tr>
<td>Junior</td>
<td>133</td>
<td>575</td>
<td>2.57</td>
<td>2.48</td>
<td>0.83</td>
<td>1.06</td>
</tr>
<tr>
<td>Senior</td>
<td>125</td>
<td>971</td>
<td>2.70</td>
<td>2.59</td>
<td>0.74</td>
<td>1.10</td>
</tr>
<tr>
<td>Athlete</td>
<td>92</td>
<td>116</td>
<td>2.19</td>
<td>2.13</td>
<td>0.95</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Table 3.IV: Aggregate Data

A careful perusal of the above table would indicate that Study Table participant subgroup performance exceeded that of non-participant subgroup by a significant margin in each category. Inferential Statistics will be used to concretize this outcome subsequently.

4. FALL 2011 STUDY TABLE DATA ANALYSIS AND FINDINGS

In this section, inferential statistical technique is used to validate the impact of Study Table project on student achievement for fall 2011. We assume (see Section 2 of this paper) that all participants come with same characteristics, and no effort is made to recruit brighter students or exclude academically weaker students. Hence, we exclude any other attributes which could impact, in any significant way, student achievement other than the Study Table activities. Subsequent hypotheses testing will rely on the properties of the Study Table project data as presented in Table 3.IV. We anticipate that at the end of the semester, participant subgroup achievement will exceed that of non-participant subgroup in each category: the attribute of comparison being the end-of-semester mean GPA.

The Hypotheses are as follows:
Null Hypothesis: There is no difference between the performance of participant subgroup and non-participant subgroup, that is, 
\[ H_0 : \mu_1 = \mu_2, \]
where \( \mu_1 \) is the mean GPA of the participant group and \( \mu_2 \) is the mean GPA of the non-participant subgroup.

Alternative Hypothesis: Participant subgroup performance exceeds non-participant subgroup performance, that is,
\[ H_1 : \mu_1 > \mu_2. \]

We shall use testing the Difference between Two Means. We shall apply one-tail test. Here,
\[
z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}
\] (4.1)

4.1: Freshman Data

Let us notice that the mean GPA of all freshmen is 2.15. Since participants and non-participants come from the same population, \( \mu_{11} = \mu_{12} = 2.15 \).

Now, the participant sample has a mean GPA \( \bar{X}_{11} = 2.34 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{12} = 1.96 \).

\[
z_{41} = \frac{(\bar{X}_{11} - \bar{X}_{12}) - (\mu_{11} - \mu_{12})}{\sqrt{\frac{\sigma_{11}^2}{n_{11}} + \frac{\sigma_{12}^2}{n_{12}}}} = \frac{(2.34 - 1.96) - 0}{\sqrt{\frac{(0.94)^2}{754} + \frac{(1.18)^2}{815}}} = 7.080452253.
\]

We use the t-distribution with \( n_{11} - 1 \) or \( n_{12} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 753 \), we use the \( t \)-table (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_\alpha = 1.647 \). Since \( z_{41} = 7.08 > 1.647 = z_\alpha \), we reject the Null Hypothesis and accept the Alternative Hypothesis which states that the participant subgroup achievement exceeds that of nonparticipant subgroup. We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean GPA of freshman participant subgroup exceeds the GPA of freshman nonparticipant subgroup significantly.

4.2: Sophomore Data

Fall 2011 semester mean GPA of all sophomores is 2.45, the mean GPA of Study Table sophomore participant subgroup is 2.55, while that of nonparticipant subgroup is 2.40, please see Table 3.VIA above. Since participant subgroup and nonparticipant subgroup come from the same population, \( \mu_{21} = \mu_{22} = 2.45 \).

Now, the participant sample has the mean GPA \( \bar{X}_{21} = 2.55 \). Nonparticipant sample has the mean GPA \( \bar{X}_{22} = 2.40 \).

\[
z_{42} = \frac{(\bar{X}_{21} - \bar{X}_{22}) - (\mu_{21} - \mu_{22})}{\sqrt{\frac{\sigma_{21}^2}{n_{21}} + \frac{\sigma_{22}^2}{n_{22}}}} = \frac{(2.55 - 2.40) - 0}{\sqrt{\frac{(0.85)^2}{173} + \frac{(1.05)^2}{627}}} = 1.947120518
\]

We use the t-distribution with \( n_{21} - 1 \) or \( n_{22} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 172 \), we use the \( t \)-table (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_\alpha = 1.656 \). Since \( z_{42} = 1.947 > 1.656 = z_\alpha \), we reject the null hypothesis and accept the Alternative Hypothesis which states that the participant subgroup achievement exceeds that of nonparticipant subgroup.
4.3: Junior Data

Fall 2011 semester mean GPA of all juniors is 2.49, the mean GPA of Study junior participants is 2.57 while that of nonparticipants is 2.48, please see Table 3.IV. Since participants and nonparticipants come from the same population, \( \mu_{32} = \mu_{32} = 2.49 \).

Now, the participant sample has a mean GPA \( \bar{X}_{31} = 2.57 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{32} = 2.48 \).

\[
z_{43} = \frac{(\bar{X}_{31} - \bar{X}_{32}) - (\mu_{31} - \mu_{32})}{\sqrt{\frac{\sigma^2_{31}}{n_{31}} + \frac{\sigma^2_{32}}{n_{32}}}} = \frac{(2.57 - 2.48) - 0}{\sqrt{\frac{(0.83)^2}{133} + \frac{(1.06)^2}{575}}} = 1.065571177
\]

We use the t-distribution with \( n_{31} - 1 \) or \( n_{32} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 132 \), we use the \( t-table \) (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_{\alpha} = 1.654 \) Since \( z_{43} = 1.066 < 1.654 = z_{\alpha} \), we conclude that there is no difference in the performance of the participant group and the nonparticipant group. We do not reject the Null Hypothesis.

4.4: Senior Data

The end of fall 2011 semester mean GPA of all seniors is 2.57, the mean GPA of Study Table senior participants is 2.70 while that of nonparticipants is 2.59, please see Table 3.VIA above. Since participants and nonparticipants come from the same population, \( \mu_{42} = \mu_{42} = 2.57 \).

Now, the participant sample has a mean GPA \( \bar{X}_{41} = 2.70 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{42} = 2.57 \).

\[
z_{44} = \frac{(\bar{X}_{41} - \bar{X}_{42}) - (\mu_{41} - \mu_{42})}{\sqrt{\frac{\sigma^2_{41}}{n_{41}} + \frac{\sigma^2_{42}}{n_{42}}}} = \frac{(2.70 - 2.57) - 0}{\sqrt{\frac{(0.74)^2}{125} + \frac{(1.10)^2}{971}}} = 1.733034815
\]

We shall use the t-distribution with \( n_{41} - 1 \) or \( n_{42} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 124 \), we use the \( t-table \) (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_{\alpha} = 1.654 \) Since \( z_{44} = 1.733 > 1.654 = z_{\alpha} \), we reject the Null Hypothesis and accept the Alternative Hypothesis which states that the participant group achievement exceeds that of nonparticipant group. We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean GPA of senior participant group exceeds the GPA of senior nonparticipant group significantly. Athlete and Learning Support data can be analyzed analogously.
5. SPRING 2012 STUDY TABLE DATA DESCRIPTION

During the spring of 2012, 3878 undergraduates were enrolled at XYZ University, with 3338 (86.08%) enrolling as full-time while 540 (13.92%) enrolled as part-time students. 1265 freshmen were enrolled, with 1166 or 92.17% enrolled as full-time students. The total number of students who received help at Study Table was 979. Of this number, 533 or 54.44% were freshmen, 228 or 23.29% were sophomores, 130 or 13.28% were juniors, and 88 or 8.99% were seniors. 107 athletes participated and 76 students belonging to the Learning Support cohort participated.

Table 5.1A represents the enrollment numbers in each category during spring 2012. Observe that while fall 2011 mean GPA of the freshman cohort is 2.15, spring 2012 mean GPA of the freshman cohort is 2.10, a decrease of 0.05. While 0.05 is numerically a small number, it has wider and deeper ramification for student progression and retention.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>End of Semester Mean GPA</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Undergraduates</td>
<td>3878</td>
<td>2.37</td>
<td>1.104</td>
</tr>
<tr>
<td>Freshman</td>
<td>1265</td>
<td>2.10</td>
<td>1.148</td>
</tr>
<tr>
<td>Sophomore</td>
<td>834</td>
<td>2.38</td>
<td>1.031</td>
</tr>
<tr>
<td>Junior</td>
<td>737</td>
<td>2.55</td>
<td>0.970</td>
</tr>
<tr>
<td>Senior</td>
<td>1025</td>
<td>2.55</td>
<td>1.128</td>
</tr>
<tr>
<td>Athlete</td>
<td>219</td>
<td>2.22</td>
<td>0.925</td>
</tr>
<tr>
<td>Learning Support Students</td>
<td>200</td>
<td>1.89</td>
<td>1.205</td>
</tr>
</tbody>
</table>

Table 5.1A: Spring 2012 Enrollment and Mean GPA from Final Grades

Table 5.1B is a distribution of full-time undergraduate enrollment and associated statistics for spring 2012. There is no difference between the spring 2012 mean GPA of all students and that of full-time students. Similarly, there is no difference between the mean GPA of the freshman cohort and that of full-time freshman cohort.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>End of Semester Mean GPA</th>
<th>Semester Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total of Fulltime Undergraduate Students</td>
<td>3338</td>
<td>2.37</td>
<td>1.069</td>
</tr>
<tr>
<td>Full Time Freshman</td>
<td>1166</td>
<td>2.11</td>
<td>1.110</td>
</tr>
<tr>
<td>Full Time Sophomore</td>
<td>720</td>
<td>2.43</td>
<td>0.993</td>
</tr>
<tr>
<td>Full Time Junior</td>
<td>618</td>
<td>2.57</td>
<td>0.895</td>
</tr>
<tr>
<td>Full Time Senior</td>
<td>833</td>
<td>2.53</td>
<td>1.122</td>
</tr>
<tr>
<td>Full Time Athlete</td>
<td>214</td>
<td>2.23</td>
<td>0.917</td>
</tr>
<tr>
<td>Learning Support</td>
<td>191</td>
<td>1.91</td>
<td>1.186</td>
</tr>
</tbody>
</table>

5.1B: Fulltime Enrollment for Spring 2012
Table 5.II is the spring 2012 study table participant data distribution and the associated statistics. While the spring 2012 semester Mean GPA of the freshman cohort is 2.10, the mean GPA of the Study Table Participant subgroup is 2.28, and the nonparticipant subgroup is 1.97. Clearly, the participant subgroup outperformed the nonparticipant subgroup significantly.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Average Number of College Credit Hours Completed</th>
<th>End of Semester Mean GPA</th>
<th>End of Semester Mean GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # of Undergraduate Students</td>
<td>928</td>
<td>11.11</td>
<td>2.42</td>
<td>0.954</td>
</tr>
<tr>
<td>Freshman</td>
<td>515</td>
<td>10.13</td>
<td>2.29</td>
<td>1.012</td>
</tr>
<tr>
<td>Sophomore</td>
<td>214</td>
<td>11.83</td>
<td>2.48</td>
<td>0.857</td>
</tr>
<tr>
<td>Junior</td>
<td>121</td>
<td>12.90</td>
<td>2.73</td>
<td>0.680</td>
</tr>
<tr>
<td>Senior</td>
<td>78</td>
<td>12.81</td>
<td>2.61</td>
<td>1.024</td>
</tr>
<tr>
<td>Athlete</td>
<td>105</td>
<td>10.27</td>
<td>2.12</td>
<td>0.958</td>
</tr>
<tr>
<td>LS</td>
<td>76</td>
<td>8.01</td>
<td>2.17</td>
<td>1.021</td>
</tr>
</tbody>
</table>

Table 5.II: Study Table Participant Data Spring 2012

Table 5.III presents aggregated data for each of the categories and their associated subgroups, namely, the participant subgroup and the non-participant subgroup for spring 2012.

<table>
<thead>
<tr>
<th>Category</th>
<th>Participant</th>
<th>Non-Participant</th>
<th>End Semester Mean GPA of Participant</th>
<th>End of Semester Mean GPA of Participant</th>
<th>Standard Deviation of Participant</th>
<th>Standard Deviation of Non-Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Undergraduates</td>
<td>979</td>
<td>2899</td>
<td>2.41</td>
<td>2.36</td>
<td>0.769</td>
<td>1.148</td>
</tr>
<tr>
<td>Freshman</td>
<td>533</td>
<td>723</td>
<td>2.28</td>
<td>1.97</td>
<td>1.027</td>
<td>1.213</td>
</tr>
<tr>
<td>Sophomore</td>
<td>228</td>
<td>606</td>
<td>2.46</td>
<td>2.36</td>
<td>0.573</td>
<td>1.085</td>
</tr>
<tr>
<td>Junior</td>
<td>130</td>
<td>607</td>
<td>2.70</td>
<td>2.52</td>
<td>0.693</td>
<td>1.018</td>
</tr>
<tr>
<td>Senior</td>
<td>88</td>
<td>937</td>
<td>2.61</td>
<td>2.55</td>
<td>0.521</td>
<td>1.140</td>
</tr>
<tr>
<td>Athlete</td>
<td>107</td>
<td>112</td>
<td>2.10</td>
<td>2.33</td>
<td>0.770</td>
<td>0.874</td>
</tr>
<tr>
<td>Learning Support</td>
<td>76</td>
<td>124</td>
<td>2.17</td>
<td>1.72</td>
<td>0.895</td>
<td>1.248</td>
</tr>
</tbody>
</table>

Table 3.III: Aggregate Data

Remark: Participant mean GPA exceeds nonparticipant mean GPA in all categories except the Athlete category. Of course, most athletes would not seek additional help if they meet the minimum requirement to remain an athlete.
6. SPRING 2012 STUDY TABLE DATA ANALYSIS AND FINDINGS

In this section, we shall use inferential statistical technique to validate the impact of Study Table project on student achievement for fall 2012. We assume (see Section 2 of this paper) that all participants come with same characteristics, and no effort is made to recruit brighter students. Hence, we exclude any other attributes which could impact, in any significant way, student achievement other than the Study Table activities. Below is table showing various categories and various parameters.

We anticipate that at the end of the semester, participant achievement will exceed that of nonparticipants in each category: the attribute of comparison being the end-of-semester mean GPA.

We state the Hypotheses as follows:

Null Hypothesis: There is no difference between the performance of participants and nonparticipants.

\[ H_0 : \mu_1 = \mu_2. \]

Alternative Hypothesis: Participant performance exceeds nonparticipant performance.

\[ H_1 : \mu_1 > \mu_2. \]

We shall use testing the Difference between Two Means. We shall apply one-tail test. Here,

\[
z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}
\]

6.1: Freshman Data: Let us notice that the mean GPA of all freshmen for spring 2012= 2.10. Since participants and nonparticipants come from the same population, \( \mu_{11} = \mu_{12} = 2.10 \). Now, the participant group has a mean GPA \( \bar{X}_{11} = 2.28 \). Nonparticipant group has a mean GPA of \( \bar{X}_{12} = 1.97 \). Hence \( t \) computed from the data is

\[
z_{0.05} = \frac{(2.28 - 1.97) - 0}{\sqrt{\frac{(1.027)^2}{533} + \frac{(1.213)^2}{723}}} = 4.893010388
\]

We shall use the t-distribution with \( n_{11} - 1 \) or \( n_{12} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 523 \), we use the \( t-table \) (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_{0.05} = 1.647 \). Since \( z_t = 4.8930 > 1.648 = z_{0.05} \), we reject the Null Hypothesis and accept the Alternative Hypothesis which states that the participant group achievement exceeds that of nonparticipant group.
Conclusion: We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean GPA of freshman participant group exceeds the GPA of freshman nonparticipant group significantly.

6.2: Sophomore Data. The end of fall spring 2012 semester mean GPA of all sophomores is 2.38, the mean GPA of Study sophomore participants was 2.46, while that of nonparticipants was 2.36, please see Table 3.VIA above. Since participants and nonparticipants come from the same population, \( \mu_{21} = \mu_{22} = 2.38 \). Now, the participant sample has a mean GPA \( \bar{X}_{21} = 2.46 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{22} = 2.36 \).

\[
\frac{(\bar{X}_{21} - \bar{X}_{22}) - (\mu_{21} - \mu_{22})}{\sqrt{\frac{\sigma_{21}^2}{n_{21}} + \frac{\sigma_{22}^2}{n_{22}}}} = \frac{(2.46 - 2.36) - 0}{\sqrt{\frac{(0.573)^2}{228} + \frac{(1.085)^2}{606}}} = 1.719377139
\]

We shall use the t-distribution with \( n_{21} - 1 \) or \( n_{22} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 227 \), we use the \( t - table \) (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_{\alpha} = 1.657 \). Since \( z_{62} = 1.719 > 1.656 = z_{\alpha} \), we reject the null hypothesis and accept the Alternative Hypothesis which states that the participant group achievement exceeds that of nonparticipant group.

Conclusion: We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean GPA of sophomore participant group exceeds the mean GPA of sophomore nonparticipant group significantly.

6.3: Junior Data. The end of Spring 2012 semester mean GPA of all juniors is 2.57, the mean GPA of Study junior participants is 2.70 while that of nonparticipants is 2.52, please see Table 3.VIA above. Since participants and nonparticipants come from the same population, \( \mu_{31} = \mu_{32} = 2.57 \). Now, the participant sample has a mean GPA \( \bar{X}_{31} = 2.70 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{32} = 2.52 \).

\[
\frac{(\bar{X}_{31} - \bar{X}_{32}) - (\mu_{31} - \mu_{32})}{\sqrt{\frac{\sigma_{31}^2}{n_{31}} + \frac{\sigma_{32}^2}{n_{32}}}} = \frac{(2.70 - 2.52) - 0}{\sqrt{\frac{(0.693)^2}{130} + \frac{(1.018)^2}{607}}} = 2.449147027
\]

We shall use the t-distribution with \( n_{31} - 1 \) or \( n_{32} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 129 \), we use the \( t - table \) (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_{\alpha} = 1.654 \). Since \( z_{63} = 2.449 > 1.654 = z_{\alpha} \), we reject the null hypothesis and accept the Alternative Hypothesis which states that the participant group achievement exceeds that of nonparticipant group.

Conclusion: We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean GPA of junior participant group exceeds the GPA of junior nonparticipant group significantly.

6.4: Senior Data. At the end of spring 2012 semester., the semester mean GPA of all seniors was 2.55, the mean GPA of Study Table senior participants is 2.61 while that of nonparticipants is 2.55, please see Table
3.VA above. Since participants and nonparticipants come from the same population, \( \mu_{42} = \mu_{42} = 2.55 \). Now, the participant sample has a mean GPA \( \bar{X}_{41} = 2.61 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{42} = 2.55 \).

\[
\begin{align*}
z_{64} &= \frac{(\bar{X}_{41} - \bar{X}_{42}) - (\mu_{41} - \mu_{42})}{\sqrt{\frac{\sigma^2_{41}}{n_{41}} + \frac{\sigma^2_{42}}{n_{42}}}} = \frac{(2.61 - 2.55) - 0}{\sqrt{\frac{(0.521)^2}{88} + \frac{(1.140)^2}{937}}} = 0.8972694027
\end{align*}
\]

We shall use the t-distribution with \( n_{41} - 1 \) or \( n_{42} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 87 \), we use the t-table (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_\alpha = 1.654 \). Since \( z_4 = 0.8973 < 1.664 = z_\alpha \), we do not reject the null hypothesis.

**Conclusion:** We conclude that there is no significant difference between academic achievement of participants and that of nonparticipant during spring 2012 semester.

6.5: Learning Support Cohort. The end of Spring 2012 semester mean GPA of all Learning Support students was 1.89, the mean GPA of Learning support study table participants was 2.17 while that of nonparticipants was 1.72, please see Table 3.VIA above. Since participants and nonparticipants come from the same population, \( \mu_{52} = \mu_{52} = 1.89 \).

Now, the participant sample has a mean GPA \( \bar{X}_{51} = 2.17 \). Nonparticipant sample has a mean GPA of \( \bar{X}_{52} = 1.72 \).

\[
\begin{align*}
z_{65} &= \frac{(\bar{X}_{51} - \bar{X}_{52}) - (\mu_{51} - \mu_{52})}{\sqrt{\frac{\sigma^2_{51}}{n_{51}} + \frac{\sigma^2_{52}}{n_{52}}}} = \frac{(2.17 - 1.72) - 0}{\sqrt{\frac{(0.895)^2}{76} + \frac{(1.248)^2}{124}}} = 2.960762199
\end{align*}
\]

We shall use the t-distribution with \( n_{51} - 1 \) or \( n_{52} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 75 \), we use the t-table (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_\alpha = 1.654 \). Since \( z_4 = 2.9608 > 1.665 = z_\alpha \), we reject the null hypothesis and accept the Alternative Hypothesis which states that the participant group achievement exceeds that of nonparticipant group.

**Conclusion:** We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean GPA of LS participant group exceeds the Mean GPA of LS nonparticipant group significantly.

6.6: Athlete Students: A perusal of the athlete data indicates that nonparticipant group performed better than the participant group significantly. The reason for this is obvious: athletes who keep reasonable grades do not bother to attend additional help sessions. Moreover, once their GPA become decent, they tend not to seek for help. But there is a program in place at XYZ University which requires athletes who are performing poorly academically to attend Study Table.
7. STUDY TABLE DATA ANALYSIS AND FINDINGS: END OF 2011-2012 ACADEMIC YEAR

It is essential to examine the overall cumulative student achievement at the end of the academic year. Although there are several cofounding variable which could perturb outcomes, a focus at the most at risk cohorts is essential. It turns out the overall student achievement would increase if there is a significant improvement in the academic achievement of traditionally at risk cohorts. In this section, we shall examine the performance of various categories of students and draw inferences from their performances.

We shall draw the computations from the table of parameters and statistics below.

Table 6.1 Aggregate Data: End of 2012 Academic Year Mean Cumulative GPA Spring 2012 Semester participant and non-participant data

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>End of Semester Mean Cumulative GPA</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduates</td>
<td>3878</td>
<td>2.53</td>
<td>0.727</td>
</tr>
<tr>
<td>Freshman</td>
<td>1265</td>
<td>2.19</td>
<td>0.995</td>
</tr>
<tr>
<td>Sophomore</td>
<td>834</td>
<td>2.58</td>
<td>0.546</td>
</tr>
<tr>
<td>Junior</td>
<td>737</td>
<td>2.69</td>
<td>0.499</td>
</tr>
<tr>
<td>Senior</td>
<td>1025</td>
<td>2.78</td>
<td>0.456</td>
</tr>
<tr>
<td>Athlete</td>
<td>219</td>
<td>2.31</td>
<td>0.728</td>
</tr>
<tr>
<td>LS</td>
<td>200</td>
<td>1.99</td>
<td>1.047</td>
</tr>
</tbody>
</table>

Remark: Spring 2012 semester Mean GPA of all freshmen is 2.10 and that of the Learning Support Cohort is 1.89. Both the freshman and Learning Support cohorts are traditionally at risk cohorts at XYZ University.

Table 6.1 Aggregate Data: End of 2012 Academic Year Mean Cumulative GPA Spring 2012 Semester participant and non-participant data

<table>
<thead>
<tr>
<th>Category</th>
<th>Participant</th>
<th>Non-Participant</th>
<th>End Semester Mean Cumulative GPA of Participant</th>
<th>End of Semester Mean Cumulative GPA of Non Participant</th>
<th>Standard Deviation of Participant</th>
<th>Standard Deviation Non Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Undergraduates</td>
<td>979</td>
<td>2899</td>
<td>2.47</td>
<td>2.55</td>
<td>0.709</td>
<td>0.712</td>
</tr>
<tr>
<td>Freshman</td>
<td>533</td>
<td>723</td>
<td>2.31</td>
<td>2.10</td>
<td>0.879</td>
<td>0.997</td>
</tr>
<tr>
<td>Sophomore</td>
<td>228</td>
<td>606</td>
<td>2.56</td>
<td>2.59</td>
<td>0.573</td>
<td>0.536</td>
</tr>
<tr>
<td>Junior</td>
<td>130</td>
<td>607</td>
<td>2.72</td>
<td>2.68</td>
<td>0.533</td>
<td>0.492</td>
</tr>
<tr>
<td>Senior</td>
<td>88</td>
<td>937</td>
<td>2.78</td>
<td>2.78</td>
<td>0.521</td>
<td>0.450</td>
</tr>
<tr>
<td>Athlete</td>
<td>107</td>
<td>112</td>
<td>2.20</td>
<td>2.42</td>
<td>0.770</td>
<td>0.587</td>
</tr>
<tr>
<td>LS</td>
<td>76</td>
<td>124</td>
<td>2.26</td>
<td>1.82</td>
<td>0.895</td>
<td>1.102</td>
</tr>
</tbody>
</table>
We anticipate that at the end of the 2011-2012 academic year, participant achievement will exceed that of nonparticipants in most categories: the attribute of comparison being the end-of-academic year Mean Cumulative GPA.

We state the Hypotheses as follows:

Null Hypothesis: At the end of the academic year there is no difference between participant academic achievement and nonparticipant academic achievement. That is, \( H_0 : \mu_1 = \mu_2 \).

Alternative Hypothesis: Participant academic achievement exceeds nonparticipant academic achievement significantly. \( H_1 : \mu_1 > \mu_2 \).

We shall use testing the Difference between Two Mean Cumulative GPAs. We shall apply one-tail test. Here,

\[
z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}
\]

**7.1: Freshman Data.** Notice that the mean Cumulative GPA of all freshmen at the end of 2012 academic year is 2.19. Since participants and nonparticipants come from the same population, \( \mu_{11} = \mu_{12} = 2.19 \).

Now, the participant subgroup has a mean Cumulative GPA \( \bar{X}_{11} = 2.31 \). Nonparticipant group has a mean Cumulative GPA of \( \bar{X}_{12} = 2.10 \). Hence the \( t \) computed from the data is

\[
z_{11} = \frac{(\bar{X}_{11} - \bar{X}_{12}) - (\mu_{11} - \mu_{12})}{\sqrt{\frac{\sigma_{11}^2}{n_{11}} + \frac{\sigma_{12}^2}{n_{12}}}} = \frac{(2.31 - 2.10) - 0}{\sqrt{\frac{(0.879)^2}{533} + \frac{(0.997)^2}{723}}} = 3.9514.
\]

We shall use the \( t \)-distribution with \( n_{11} - 1 \) or \( n_{12} - 1 \) degrees of freedom whichever is less. Hence, using \( df = 532 \), we use the \( t \)-table (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with \( \alpha = 0.05 \), to obtain \( z_{0.05} = 1.647 \). Since \( z_{1} = 3.9514 > 1.648 = z_{0.05} \), we reject the Null Hypothesis and accept the Alternative Hypothesis which states that the participant group achievement exceeds that of nonparticipant group.

**Conclusion:** We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean Cumulative GPA of freshman participant group exceeds the mean Cumulative GPA of freshman nonparticipant group significantly.

**7.2: Learning Support Cohort.** The end of Spring 2012 semester mean Cumulative GPA of all Learning Support students was 1.99, the mean Cumulative GPA of Learning support study table participants was
2.26, while that of nonparticipants was 1.82, please see Table 3.VIA above. Since participants and nonparticipants come from the same population, $\mu_{s1} = \mu_{s2} = 1.99$. Now, the participant sample has a mean GPA $\bar{X}_{s1} = 2.26$. Nonparticipant sample has a mean GPA of $\bar{X}_{s2} = 1.82$.

$$z_{s2} = \frac{(\bar{X}_{s1} - \bar{X}_{s2}) - (\mu_{s1} - \mu_{s2})}{\sqrt{\frac{\sigma^2_{s1}}{n_{s1}} + \frac{\sigma^2_{s2}}{n_{s2}}}} = \frac{(2.26 - 1.82) - 0}{\sqrt{\frac{(0.895)^2}{76} + \frac{(1.102)^2}{124}}} = 3.0857.$$  

We shall use the $t$-distribution with $n_{s1} - 1$ or $n_{s2} - 1$ degrees of freedom whichever is less. Hence, using $df = 75$, we use the $t$-table (see Bluman [1], Hogg, McKean, and Craig [2]), one tail-test with $\alpha = 0.05$, to obtain $z_{\alpha} = 1.654$ Since $z_{s} = 3.0857 > 1.665 = z_{\alpha}$, we reject the Null Hypothesis and accept the Alternative Hypothesis which states that the participant group achievement during the academic year exceeds that of nonparticipant group.

**Conclusion**: We reject the Null Hypothesis and hence accept the Alternative Hypothesis which states that the mean Cumulative GPA of Learning Support participant group exceeds the mean Cumulative GPA of Learning Support nonparticipant group significantly.

7.3: Other Cohorts: An examination of the Table 6.1 indicates that the mean Cumulative GPA of the participant and nonparticipant groups in sophomore, junior, and senior categories are essentially the same. The mean cumulative GPA nonparticipant subgroup of athletes exceeds that of the participant group. As stated earlier, students in these categories who are not at risk do not see any reason to seek for additional help. These groups of students are satisfied with above average GPAs. This is an issue which should be tackled through advisement.

8. PREVIOUS INTERVENTIONS

As stated earlier, XYZ University had implemented various interventions in the past. These interventions have garnered a variety of successes. Let us compare the Study Table project and the other projects of the past. During the 2010-2011 academic year, 775 students received Supplemental Instruction with possible duplications since they were mostly in Math and the sciences. 263 received tutorial support from peer tutors. It is also possible that a critical number of students who received SI received peer tutorial services. Assuming that about half the number is replicated, (We do not have any educational guess to do so), we could have 519 unduplicated number of students who received SI and peer tutoring services during that academic year. During the fall of 2011, 1190 students participated in the Study Table. In the spring 2012, 979 students participated; hence an average of 1085 students participated in Study Table every semester. Our conclusion here is 100% increase in the number of students who participated in the Study Table than number which sought help during the previous year.

9. PARTICIPANT SURVEYS AND FINDINGS

During the last week of fall 2011 Study Table activities, a survey was administered to Study Table participants (see Appendix II). The goal of the survey was to gauge participant interest as well as
participant anticipated impact of the Study Table on their academic achievement, (see Appendix I). One hundred and thirty-four participants completed the survey. Of this number, 68 were freshmen, 13 were sophomores, 15 were juniors, 10 were seniors, and 28 were unclassified as they did not indicate in the survey their classifications. By invoking proportional representation, it is easy to state that about 18 of the 28 unclassified students were freshmen. This means that about 62.31% or 86 of the 134 survey participants were freshmen. We note here that freshmen constituted 63.36% of Study Table participants. Here are the results.

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor’s teaching/tutorial methods during Study Table sessions help me understand the subject matter better</td>
<td>96.1%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

Of the 128 students who answered question 1, 123 or 96.10% strongly agree or agree with the statement that the instructor’s teaching methods during Study Table Sessions helped them understand the subject matter while 5 or 3.90% disagree or strongly disagree with the statement. Hence there was an overwhelming perception that tutors’ instructional techniques were very helpful.

<table>
<thead>
<tr>
<th>Question 2</th>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor’s problem-solving sessions help me improve my grade</td>
<td>95.97%</td>
<td>4.03%</td>
</tr>
</tbody>
</table>
One hundred and twenty-four participants answered this question. Of this number, 119 participants or 95.97% strongly agreed or agree that Instructor’s problem-solving sessions helped them improve their grades, while 5 participants disagree or strongly disagree with the statement. This implies that teaching and learning was very effective during Study Table sessions.

<table>
<thead>
<tr>
<th>Question 3</th>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small group activities help me learn how to solve mathematical problems</td>
<td>93.8%</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

129 participants answered this question. Of this number, 121 or 93.80% strongly agree or agree that small group activities helped them to learn how to solve math problems while 7 or 5.40% disagree or strongly disagree. This question has an overwhelming positive result.

<table>
<thead>
<tr>
<th>Question 4</th>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Study Table instructors’ presentations are very interesting | 88.46% | 11.54%

88.46% of the participants who answered this question or 115 out of 130 strongly agree or agree that instructors’ presentation were very interesting while 15 or 11.54% disagree. There is need to reexamine this question in order to rephrase it for subsequent surveys. However, most participants concur with the statement.

<table>
<thead>
<tr>
<th>Question 5</th>
<th>Strongly Agree/Agree</th>
<th>Disagree/Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like active participation of students at Study Table</td>
<td>98.44%</td>
<td>1.56%</td>
</tr>
</tbody>
</table>

Of the 129 participants who answered this question, 127 or 98.44% strongly agree or agree with the statement that students are active participants and engage in learning during Study Table sessions. Only 2 or 1.56% disagree with the statement.

<table>
<thead>
<tr>
<th>Question 6</th>
<th>Strongly Agree</th>
<th>Disagree/Strongly</th>
</tr>
</thead>
</table>
Of 105 participants who responded to the question, 102 or 97.12% strongly agree or agree that they will attend Study Table sessions next semester while 3 or 2.86% disagree or strongly disagree. Having a 97% return rate is overwhelming.

<table>
<thead>
<tr>
<th>Question 7</th>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Table participation helps me improve my grades</td>
<td>98.08%</td>
<td>1.92%</td>
</tr>
</tbody>
</table>

Of the 104 students who responded to this question, 102 or 98.08% strongly agree or agree with the statement that Study Table sessions help them improve their grades, but 2 or 1.92% disagree or strongly disagree. There was an overwhelming belief that the Study Table sessions have positive impact on student achievement.
Question 8

<table>
<thead>
<tr>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will recommend Study Table participation to other students in my class</td>
<td>100%</td>
</tr>
</tbody>
</table>

All the 104 students or 100% of participants who responded to this question stated that they would recommend Study Table participation to other students. This positive response is very strong because participants indeed have experienced help and this was exemplified by the grades they received after attending Study Table sessions. This is perhaps the most important response of the questionnaire.

Question 9

<table>
<thead>
<tr>
<th>Strongly Agree /Agree</th>
<th>Disagree/ Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examining all the above qualities, including those you might add, how would you rate the quality of instruction and learning you receive in Study Table sessions</td>
<td>98.06%</td>
</tr>
</tbody>
</table>
Of the 103 students who responded to this question, 101 or 98.06% gave positive rating to the instruction and learning received during Study Table Sessions while 2 or 1.94% rated it poor.

10. CONCLUSION

In this paper, an assessment of the fall 2011 Study Table project activities has been presented. It is seen that the Study Table Participants’ achievement exceeds that of nonparticipants in every category. These results have been presented as frequency distributions and graphs in Section 3. In particular, attention is focused on the freshman and sophomore cohorts. In order to validate the conclusions derived from the distributions, inferential statistical techniques were used to give credence to the results. Statistical Hypothesis Testing was used and most results showed that participant cohorts had higher academic achievement than the nonparticipant cohort.

In order to sustain the Study Table project, efforts should be made to draw attention of all deans, chairs, and faculty to the result of this study. Essentially,

(i) The report should be shared with the academic leadership and faculty
(ii) Participation should be made compulsory for all freshmen in their first year.
(iii) Participation should be made compulsory for all students whose GPA drop below 2.5
(iv) Departments should include Study Table participation as part of their retention efforts.
(v) There is need to improve data collection efforts by locally reposing data.
(vi) All instructors and tutors should undergo orientation and training which delineate what the expectations are at beginning of every semester.
(vii) There is need to bring in more tutors and instructors in certain areas of need which have demonstrated increased load, for example, mathematics.
REFERENCES


HEALTH AND ENVIRONMENTAL FACTORS OF AUTISM IN ASABA

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Abstract
Teachers in schools could face the challenge of planning and implementing effective education programs for all students, including students with autism, which can be prevented in our society if deliberate attempts are made to identify its causes. This study investigated health (an inherited disorder that causes intellectual problems, low birth weight, tuberous sclerosis and having an older parent) and environmental (exposures to toxic chemicals, the wrong chemical at the wrong time and noise) factors that could lead to autism in Asaba metropolis. A descriptive survey design was adopted. The respondents for this study consisted of 100 (20.0%) teachers and 400 (80.0%) students from five secondary schools within Asaba metropolis in Delta State. The instrument sought for “Yes” or “No” responses from the respondents. Collected data were collated and analyzed with descriptive statistics of frequency count and percentage as well as non-parametric statistics of chi-square ($X^2$) for the two hypotheses. Results show that both factors could lead to autism. It was recommended that our future leaders be prevented from educationally threatening disorder (autism) through health and environmental care in childhood.

Introduction
Autism is a pervasive developmental disorder affecting an individual’s ability to socially communicate and interact with others and to exercise social imagination (Wing and Gould’s, 1979). Most prevalent amongst males, many individuals also demonstrate a narrow and repetitive range of interests and behaviours. There are four main subtypes of autistic spectrum disorder (ASD): classical autism, Asperger syndrome, childhood degenerative disorder and pervasive developmental disorder (not otherwise specified) (Research Autism, 2010). Classic autism and Asperger syndrome are the most commonly diagnosed, but are differentially classified in the IDC-10 (WHO, 2007) and DSM-IV (APA, 2004) publications. The triad of impairments associated with ASD has been useful for teachers when identifying the educational support needs of individual pupils with autism (Jones, English, Guldberg, Jordan, Richardson and Waltz, 2009).

Autism is a serious neuro-developmental disorder characterized by impairments in social interaction, abnormalities in verbal and nonverbal communication, and restricted, stereotyped interests and behaviors (American Psychiatric Association, 1994). Although a large proportion of individuals with autism manifest abnormal development from birth, a subset of at least 20–30% experience a regression with onset between 18 and 24 months of age after a period of apparently normal development (Lainhart, Ozonoff, Coon, Krasny, Dinh and Nice, et al. 2002). Autistic disorder is the most severe form of autism spectrum disorders (ASDs), which include Asperger’s syndrome and pervasive developmental disorders (PDDs) not otherwise specified. Approximately 70% of individuals with autistic disorder have some degree of mental retardation, and about half are nonverbal or have very impaired speech. Seizures are present by adolescence in about 30% of children with ASD, and between 5 and 10% of autism cases occur in association with other serious medical conditions such as fragile X, tuberous sclerosis, and Angelman’s syndrome (Fombonne, 2003).
Gastrointestinal problems and sleep disturbances are also thought to be common comorbidities; however, population-based prevalence estimates for these conditions are currently lacking. Males are four times as likely as females to have autism, but this ratio approaches one among individuals with severe cognitive impairment (Gillberg and Wing, 1999). Most individuals with autism cannot live independently as adults (Rapin, 1999). Over the past 20 years, the prevalence of autism has reportedly risen, with much public debate surrounding the reasons for this increase. Early reports estimated prevalence at 4–5 per 10,000 births (Fombonne, 1999). Data published in the last few years suggest that autistic disorder occurs in at least 1–2 per 1,000 births, and the prevalence of the broader autism spectrum may be as high as 4–6 per 1,000 (Chakrabarti and Fombonne, 2005; Yeargin-Allsopp, et al. 2003).

Studies have hinted at various factors around the time of birth that may increase a child’s risk of autism—but there is still too little evidence to point to specific culprits. Those include low birth weight, certain delivery complications like problems with the umbilical cord, fetal distress during labor and signs of “poor condition” in the newborn—such as problems with breathing or heart rate. And in fact, in a complex disorder like autism, it would be very unlikely that a single birth factor would stand out as the key culprit. It is known that the brains of infants and children are extremely sensitive to toxic exposures in the environment. New research has identified “critical windows of vulnerability” in fetal life and early childhood when exposures to toxic chemicals can cause devastating injury to the brain and nervous system. Research has also found that toxic chemicals can damage the developing brains of infants and children at extremely low doses. Thus, there are no safe exposure “thresholds” in early brain development, as even low-level chemical exposures have been shown to cause loss of intelligence, short attention span, and disruptive behavior.

Studies show that exposures to chemical such as lead, methyl, mercury, manganese, organophosphate pesticides, and ethyl alcohol can damage the brains of infants and children to cause autism and learning disabilities (Sloper and Turner, 1993; Daley and Sigman, 2002). Of grave concern is that this list of chemicals may be only the tip of a much larger problem. Currently, many homes have a generator that is giving room for pollution with the potential to cause childhood brain injury that could result in autism and learning disabilities. As these diseases continue to rise, there is a dire need to investigate which factors contribute to the causes of autism and learning disabilities. Now is the time to take action in discovering the health and environmental factors of autism in our society particularly, in Asaba.

**Methodology**

The sample population included teachers and students in state owned secondary schools. The descriptive survey design was adopted. The respondents for this study consisted of 100 (20.0%) teachers and 400 (80.0%) students from five secondary schools within Asaba metropolis in Delta State. A total of twenty (20) teachers and eighty (80) students from each of the schools selected participated in the study making five hundred drawn through a convenience sampling technique. A self-structured and validated instrument with a test retest reliability of 0.08 that comprises of 8 items for both health (any inherited disorder that causes intellectual problems, low birth weight, tuberous sclerosis and having an older parent) and environmental (exposures to toxic chemicals and noise) factors was used. The instrument sought for “Yes” or “No” responses from the respondents. Collected data were collated and analysed with descriptive statistics of frequency count and percentage as well as non-parametric Statistics of chi-square (X²) for the two hypotheses set at 0.05 level of significance.

**Results**

Out of the 500 respondents, 400(80.0%) has age range of 15-24 years, 25-34 years were 16.2%, 35-44 were 79 (15.8%) while 45 years and above were 5(1.0%). The study had 91 (18.2%) married respondents whereas 409 (81.8%) were single. However, were 185 (37.0%) male while 315 (63.0%) were female.
Hypothesis 1; Health Factors (any inherited disorder that causes intellectual problems, low birth weight, tuberous sclerosis and having an older parent) will not significantly lead to Autism in Asaba Delta State Nigeria

Table 1: Chi-square Analysis on Health factors of Autism

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
<th>X² value</th>
<th>df</th>
<th>P</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>397</td>
<td>79.4</td>
<td>221.566</td>
<td>7</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>103</td>
<td>20.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 showed that 397 (79.4%) posited that health factors could lead to autism compared to only 103 (20.6%) that gave contrary response. The Chi-square value of 221.566 at df =7 indicated that p< 0.05 alpha level. Hence health factors could significantly lead to autism among people in Asaba metropolis.

Hypothesis 2; Environmental Factors (exposures to toxic chemicals and noise) will not significantly lead to Autism in Asaba, Delta State Nigeria

Table 2: Chi-square Analysis on Environmental factors of Autism

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
<th>X² value</th>
<th>df</th>
<th>P</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>368</td>
<td>73.6</td>
<td>100.000</td>
<td>7</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>132</td>
<td>26.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 showed the responses of the respondents on the concept that environmental factors could be an upshot autism. 368 (73.6%) posited that environmental factors could lead to autism compared to only 132 (26.4%) that opposed the items with negative responses. The Chi-square value of 100.000 at df =7 showed that p< 0.05 alpha level. Hence environmental factors could significantly lead to autism among people in Asaba metropolis.

Discussion

The study found that both health (an inherited disorder that causes intellectual problems, low birth weight, tuberous sclerosis and having an older parent) and environmental (exposures to toxic chemicals, the wrong chemical at the wrong time and noise) factors could lead to autism. The outcome corroborate earlier studies which submitted that it is plausible that a substantial proportion of autism cases could be due to multiple genes interacting with one or more environmental factors (Cederlund and Gillberg 2004; Glasson et al. 2004). Studies of environmental factors also relate to the prenatal origin of autism. Chess et al. (1978) reported that, within a cohort of about 250 children with congenital rubella, 7% were later diagnosed with autism. Currently, the needs of children with autism all over the world are not being met in either the regular or special education systems. Children with autism are frequently refused admission to these special schools because of lack of qualified manpower and equipment to handle their needs.
Conclusion

Autism does not seem to impact one particular group more than another. Studies have also found that lifestyle, education, and income levels seem to have nothing to do with autism risk. What all this means is that there is much more research that needs to be done about autism before risk factors can be fully identified: what causes autism, which individuals are at risk for it, and whether and how it can be prevented should be researched on.

References


SUSTAINING CONCURRENCY IN MODERN DATABASE ARCHITECTURE FOR GSM NETWORKS

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Abstract
This paper investigates the techniques for the realisation of efficient concurrency control in the database architecture for Global System for Mobile communication (GSM) networks in order to reduce frequent breakdowns and poor quality of service. The research investigates basic issues of the GSM functional model such as location of roaming terminals, delivery of data packets, functions for static scenarios, location update, maintenance of connectivity for terminals moving into new locations/areas, functions for dynamic scenario handover. The paper applies Global Concept Instantiation Model and Language of Automation (the Calculus of Communicating Systems (CCS)) in the database to present possible solutions to the problems identified.

Keywords: Sustaining, Concurrency, Database, Architecture, GSM, Networks.

Introduction

The GSM system simplified version architecture of current type consists of the mobile station (MS), base station subsystem (BSS), and the Network subsystem. Respectively these include the mobile equipment that contains Subscriber Identity Module (SIM) where BSS contains two principal units, Base Transceiver Station (BTS) and Base Station Controller, (BSC) while the network subsystem contains Home Location Register (HLR), Visitor Location Register (VLR), Equipment Identity Register, (EIR) and Authentication Register, (AuC), all controlled by Mobile Switching Centre (MSC). The MSC in turn interacts with Public Switched Telephone Network PSTN/ Packet Switched Public Data Network (PSPDN), together called Gateway Mobile Switching Centre (GMSC). The present system adopts the principle of collecting data in real-time from various probes that poke the network components at different layers of the Organisation System International,(OSI) model and relaying the information back to the data collecting processes (ISO/DIS/7498,1982). The data collection facility probe server is sensor based and operates in real-time at high speed. The collected data are managed in real-time and supported with a high degree of reliability, availability, and performance thus providing a natural solution in the system setup.
Figure 1: Simplified version (GSM System Architecture)

Legend: SIM=Subscriber Identity Module, ME=Mobile Equipment, UM=Unbounded Medium, BTS=Base Transceiver Station, BSC=Base Station Controller, HLR =Home Location Register, EIR=Equipment Identity Register, VLR=Visitor Location Register, AUC=Authentication Centre, PSTN=Public Switched Telephone Network, MSC=Mobile Switching Centre, PSPDN=Packet Switched Public Data Network/Gateway Mobile Switching Centre.

The new technique/concurrency control protocol data dictionary is applied at each site in the Distributed Data Base Management System (DDBMS). This makes it easy to direct the decomposition and re-composition of query to update local sites thus assuring transparency, (Stonebreaker, 1979), (Bernstein, 1981). During execution none blocking of affected data is operational thus high speed commitment thrives. At this moment only affected data reflect the real activity in real-time.

2. Distributed Functional Model (DFM)

Fibonacci technique conforms to and has ubiquitous functional capabilities that enable it have direct access to components/data for execution (Uzoh, 2008). The various entities required for the operation are termed service functions namely: service management access function (SMAF), service creation environment function(SCEF), service management function (SMF), service control function (SCF), service data function (SDF), specialized resource function (SRF), service switching function (SSF), call control access function (CCAF), and call control function (CCF), (Sivagnanasundaram S., 1997), (ITU, Q1204), Figure 2. Access to the services and functions is made in a distributed form. Here our model defines the overall model for execution in terms of Service plane, Global functional plane, Distributed functional plane and Physical plane, Figure 3.
Service features on activation by Basic Call Process (BCP), of the following service plane, Figure 3(a), will be executed using service independent building block particles (SIBPs) in what is called global service logic. The basic call process has point of initiation (POI) in global functional plane, Figure 3(b) and point of return, (POR) to BCP (Douglas et al, 2002). The interaction of service features while executing functions in distributed service logic, routes the activities through the logical Information Flow, (IF) paths, distributed functional model, Figure 3(c) while the physical plane depicts the physical entities (PE) which are the realization of the functional entities or the network elements, (ITU, Q1205) of physical plane, Figure 3(d).
(a) Service Plane

BCP: Basic Call Process

SIB: Service Independent Building Block

GSL: Global Service Logic

POI: Point of Initiation

POR: Point of Return

(b) Global Functional Plane

DSL: Distributed Service Logic

FE: Functional Entity

DSL: Distributed Service Logic

IF: Information Flow
3. Global Concept Instantiation

The service switching function (SSF), of the distributed functional plane on being triggered on, various elements, entities, and service features, service independent building block particles (SIBPs) become ionized or raised to an activated state. In ionized state, they become abstract Meta objects and acquire potential/kinetic energy. This results to pre-clustering and global concept instantiation (Batten et al, 2001) i.e. Leading to subdivision of nodes producing reasonably uniform distribution and at the same time providing appropriate degree of search space granularity. In this higher state, service control function
directs, organizes and dictates what is to be done and the order of execution of the object oriented parameters. Here architectural, interoperability, interaction/negotiation and exploration levels are excited and each performs its desired function, relationship and information space architecture, (Uzoh, 2008) Figure 4.

At the architectural level, logical interconnection of nodes is pursued and formation of clusters/information/relationship space. Search and any information type described are potentially accessible. At the interoperability level, remote information is achieved through inter-relationship between databases. At the interaction/negotiation level, global concept organization is used as platform for information space clustering (Uzoh, 2008). Automated negotiation sessions are provided by Tassilli language primitives for creation and maintenance of object oriented information space scheme (Internet, 13). Whenever MT network transits to any of the six processing states, Figure 5; the service switching function (SSF), service control function (SCF) and call control function (CCF) simultaneously, trigger on and hence events-trigger-transition sets up in the network subsystem.

![Figure 4: Global concept instantiation](image)

4. Data Elements and Parameters in Transitional State

Within the domain of Service Control Function (SCF) is the local resource data manager and local resource data. Also here resides access manager, <switching manager>, Service Switching Manager <SSM>, <SSM events>, and <resource control>. Within the domain of Call Control Function (CCF) is the Basic call resource data manager/call manager, Basic call resource data manager, <Basic call manager>, <BCSM>, <Basic call triggers>, <Basic call events>, <Bearer events>, and Bearer Control. While all these darting moves take place simultaneously in Figure 2 above, global concept instantiation, Figure 4 triggers on, and all the processes perform their specific functions.
All the afore mentioned Meta objects are activated whenever the mobile station, (MS) is in transitional state and each of the six states is ready to perform. Figure 5.

5. Language of Automation (Robin Milner, 1980)

Given an automaton, A, we recall how to find its language \( \tilde{A} \). Let \( A \) have sets \( \{q_0, q_n\} \) with start state \( q_0 \). For \( 1 \leq i \leq n \), let \( X_i \) denote the set of strings accepted by \( A \) starting in state \( q_i \), thus \( \tilde{A}=X_0 \). For each \( X_i \), we define an equation in terms of the sets corresponding to its successor states, e.g., for \( A_0 \)

\[
\begin{align*}
(0) \quad X_0 &= ax_1 + bx_2 + cx_3 \\
(1) \quad X_1 &= ax_3 + bx_2 + cx_0 + \varepsilon \\
(2) \quad X_2 &= ax_2 + bx_3 + cx_0 \\
(3) \quad X_3 &= ax_3 + bx_3 + cx_3
\end{align*}
\]

We note that \( X_1 \) contains \( \varepsilon \) because \( q_1 \) is an accepting state, so we apply Arden’s Rule to solve the equation.

Equation (3) can be written in the form:

\[ X_3 = (a+b+c) X_3 + 0, \] so Arden’s rule yields

\[ X_3 = (a+b+c)*0 \]
Hence simplifying the equations we get:

\[ (0) \quad X_0 = aX_1 \]
\[ (1) \quad X_1 = bX_2 + cX_0 + \epsilon \]
\[ (2) \quad X_2 = cX_0 \]

Substituting (0) and (2) in (1) we get:

\[ x_1 = (bc+c)X_1 + \epsilon, \text{ so by Arden’s Rule we deduce} \]
\[ X_1 = ((bc+c) a)^* \text{ and from (0) finally} \]
\[ \hat{X} = X_0 = a ((bc+c) a)^* \]

We have used algebraic properties of union and concatenation e.g. after substituting (0) and (2) in (1) we used:

\[ bcax_1 + caX_1 = (bc+c) aX_1 \]

This is justified by the first distributive law:

\[ (S_1 + S_2)T = S_1T + S_2T \text{ and in others the second distributive Law} \]
\[ T(S_1 + S_2) = TS_1 + TS_2 \]

is applied.

6. Conclusions

With the foregoing stages of Service Features, Basic Call Process of Global Functional plane etc. and Global Concept Instantiation coupled with Distributed Functional Model and Calculus of communicating Systems (CCS), (Milner, 1980), the concurrency paradigm is achieved. Hence synchronised communication within data bases is realised (TCSC, 2004) [Technical Committee on Scalable Computing]. Here properties of parallel computation, synchronisation and non determinism techniques are called into play. The MSC in the Network Subsystem, Figure 1, concludes the rest of the operations. It collates and synchronises data from the associated data bases, activating global concept instantiation paradigms, Figure 4, while executing simultaneously the six essential functions of: Paging and Location processing, Authentication and TMSI (Temporary Mobile Subscriber Identity) Processing, Call and Handover processing [six transitional states], before retiring to idle state, Figure 5. It will be noted that the system assigns Temporary Mobile Subscriber Identity to any visitor that comes into its domain and this lasts throughout the period of connection in the new area. Thus the purpose of this paper, maintenance of connection with terminals moving into new locations/areas, function for dynamic scenario, handover is achieved. This is the dynamism, efficient data reception from and despatch to desired locations using integrated data transfer mechanism, (Uzoh, 2004), that is associated with the system. This is often noticed as the visitor is automatically registered; the name of the current backbone appears on the Mobile Station, MS.
REFERENCES


STUDENTS’ USE OF GRAMMATICAL CONCORD: AN EVALUATION OF EXAMINATION SCRIPTS OF SOME SELECTED STUDENTS AT GHANA TECHNOLOGY UNIVERSITY COLLEGE (GTUC)

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Key Words: Grammar, concord, antecedent, critical discourse and pedagogy.

Abstract

This paper investigated the use of grammatical concord in undergraduate students’ examination scripts in Ghana Technology University College (GTUC). Purposeful and critical discourse analysis methods were employed to analyze some selected sentences from some selected Communication Skills scripts of level 200 students to ascertain their proficiency of the use of grammatical concord in English second language (ESL). The paper observed that students are not proficient in the use of grammatical concord as a result of poor foundation they had in their previous schools before entering the university. The paper concluded that more exciting pedagogical methods such as teaching grammar in context, substitution tables, constant practice, amongst others, should be employed by teachers to whet students’ appetite in the language.

Introduction

Since Independence, English Language (EL) continues to play a pivotal role in day-to-day transactions of Ghanaians. Due to the relevance of EL in Ghana, the Ministry of Education (MOE) has made it a policy for the language to be taught from Kindergarten to the university level. In addition, to make the EL an indispensable medium of communication in Ghanaian educational sector, all other subjects, be it Mathematics, Science, History, Information Technology, Engineering, Business, Political Science, to mention but a few, are taught in English Language. Afful (2007:144) has observed that apart from English Language being used as an official language or Lingua Fraca in Ghana, ‘it is an important means of inter-ethnic communication internally and a source of communication with the international community – politics, trade, and science. Afful’s assertion, with regard to the usefulness of EL in the Ghanaian speech community has been buttressed by Quagie (2010), who, in extolling the role of English – Standard English, argues that he has not yet read any written manifestoes of political parties of any English speaking country in other languages other than English – Standard English.
However, it is important to mention that notwithstanding the usefulness of EL in Ghana, not much has been done to improve upon how the Language should be taught, learned let alone spoken as one would have expected. In this regard, mention can be made of how issues surrounding the teaching and learning of EL in Ghana continue to pose challenges to the Ghanaian teachers and other highly respected personalities in the academia, and students of Ghana Technology University College (GTUC) cannot be left out in this regard. Indeed, one of such basic grammatical rules which are often abused is that regarding the use of grammatical concord. For example, studies have revealed that some teachers of EL, especially those at the Junior High Schools (JHS) and Senior High Schools (SHS), are not properly trained; hence, they are not familiar with the scope and contents of the EL curriculum, let alone teaching the rudiments of the language to meet the needs and aspirations of students (Klu, 2006). It is in an attempt to find some remedies to the challenges posed by English second language that I wrote this article, which investigated some challenges encountered by level 200 students of Ghana Technology University College (GTUC).

**Literature Review**

Dulay and Burt (1977) have contended that a new language cannot be learned by anybody without ‘goofing’. This assertion by these grammarians, lends credence to the fact that second language learners are bound to make errors in their attempt to speak the second language. English grammar has many aspects which are governed by rules and these rules should be learned by anybody who wants to speak the language correctly and effectively. As a result of these challenges, many speakers of English as second language, especially in Ghana, are often confronted with certain grammatical glitches when it comes to using the rules of grammatical concord. Long (2007:606) has argued ‘for a sentence to make sense, subjects and verbs have to agree with each other…’. She goes on to assert that issues about subject-verb agreement are relevant basic skills which every student must strive to acquire. Kwofie (2011:11), drawing on *The Macmillan English Dictionary* (2007) edition argues ‘concord is the way in which words are used together correctly according to the rules of grammar’. These definitions of concord have been buttressed by Freeborn (1987) who argues ‘grammar provides the rules for putting words into the right order so that our meaning is clear’ (P. xiii). I have found Freeborn’s definition of grammar intriguing and relevant to this study in that for EL to be spoken and written effectively, the basic grammatical rules should not be violated; and since concord is an aspect of English grammar, it behooves students, teachers and users of EL to adhere to the rules governing it in order to achieve effective communication. Quirk, Greenbaum, Leech & Svarvik (2005) contend that concord is a relationship which exists between two grammatical units such that when one of them displays a particular feature, for example, plurality, that accords with a displayed feature in the other.
Thukur (2002) concords with the arguments raised by the earlier writers with regard to concord when he indicates that one of the useful rules of English Language is when the verb agrees with the subject in terms of number and person. Kwofie (2011:23), citing Yankson (1994) has argued that when second language learners commit grammatical errors, they reflect badly on their personality and that they tell listeners something about their educational background and shows their inter-language as ‘developing grammar’ that borders on illiteracy. This comment from the renowned Ghanaian scholar of ESL lends credence to the fact that one’s poor knowledge of English grammar – concord, can belittle and embarrass one in the eyes one’s audience and care must therefore be taken by ESL speakers to escape the dangers pose by the wrong use grammatical concord. Indeed, one major focus of this paper is on students and teachers who use ESL to communicate. It is the paper’s fervent hope that they would make frantic effort to minimize the rate at which errors of grammatical concord occur in their verbal and written communications, for as Thukur (2002) puts it, it is not surprising that even advanced learners and speakers of ESL sometimes get confused with some of the grammatical rules which govern the language.

**Statement of the Problem**

The issue of grammatical concord in English grammar has become an albatross hanging on the necks of both students and teachers in Ghana and elsewhere. So endemic is the problem of grammatical concord to the extent that Owusu-Ansah in a book, *English in Ghana* (1997:30) citing Yankson (1989) has argued ‘concord errors…are damaging to one’s reputation than other errors…’. This observation, with regard to the use of grammatical concord, is relevant to this study in that the issue about grammatical concord in English grammar has become an age long grammatical challenge, which needs to be tackled properly and efficiently by teachers and students of English second Language. However, it is sad to mention that although issues about grammatical concord continue to ‘torment’ both students and teachers, adequate measures have not been put in place by teachers, students, educationists and other stakeholders to improve the way and manner this aspect of English grammar should be taught, especially in Ghanaian schools, colleges and even universities. Indeed, whenever it comes to issues on grammatical concord, teachers and students narrow their thoughts to a mere subject-verb agreement, forgetting that other complex issues such as concord within tenses, notional concord, proximity concord, concord with the relative pronouns – who, which, that, whose, amongst others, remained insurmountable to both students and teachers (Quagie, 2010, 2011). It is because the issues of grammatical concord persistently linger on the necks of ESL users in Ghana and elsewhere, that is why I intend to point out certain key types of grammatical concord as mentioned earlier in this paper,
for teachers of ESL to focus attention on them in order to improve the knowledge of students and other users of ESL in this aspect of English grammar.

**The Purpose of this Paper**

The paper aims to point out certain key areas with regard to grammatical concord in ESL in Ghanaian schools and colleges for better attention to enable students to overcome such challenges in both oral and written communications. In addition, the paper has recognized to a large extent that one key factor which has accounted for the problem of English grammar – grammatical concord among students and users of ESL in Ghana and elsewhere, is the poor approach or pedagogy employed in teaching and learning the language. The paper therefore wishes to offer or recommend more useful ways or pedagogical approaches to the teaching of concord as an aspect of English grammar. More so, the paper would like to argue unequivocally that the teaching of EL at all levels of Education in Ghana and indeed elsewhere, should be a sole responsibility of trained English Language teachers (italics mine), but not any other personalities who think because they can speak and write English Language, they can teach it.

**Significance of the Study**

The paper will serve as an eye opener to teachers of ESL, students, educationists, stake-holders, ESL curriculum planners, among others, to focus much attention on the teaching and learning of grammatical concord as an aspect of English grammar. Indeed, by the time readers finish reading this article, they would realize that issues about grammatical concord cannot be taken ‘lightly’ because any infringement of the rules regarding grammatical concord can damage the reputation of a person in the eyes of the public (Yankson 1989).

**Research Questions**

This paper seeks to find answers to the following research questions:

(a) What is a grammatical concord?

(b) Why do students continuously face problems or challenges when it comes to the observance of the rules governing grammatical concord in English second language?

(c) What semantics problems are created when students violate the rules of grammatical concord?
Methodology and Research Design

A purposive sampling and critical discourse analyses approaches were used to analyze the selected test items from the students’ Communication Skills examination scripts. Alhasan (2007:53) defines a purposive sampling as a method in which the ‘researcher carefully selects the sample to reflect the purpose of the investigation’. Indeed, several grammatical issues were identified in the selected students’ scripts, but the concern of the paper was to investigate how students use grammatical concord, what challenges confront them in their bid to use grammatical concord, among others, and by so doing, offer some better ways to assist them to overcome these challenges.

In the case of critical discourse analysis approach, the work of Van Dijk (1976) was considered. In particular, in his book: Cognitive Processing of Literary Discourse (1976) Van Dijk argues that in analyzing literary texts, readers should take into account ‘highly ambiguous, vague, incomplete sentences which may occur in some kinds of literary texts’ (pg.144) and see how these can be interpreted in order to enhance the understanding of the text. I have found the assertion by Van Dijk concerning analysis of literary texts very relevant to this paper in that the sentences, which might contain some challenges with the use of grammatical concord in the selected students’ scripts would be analyzed thoroughly in order to ascertain the semantics effects or implications these grammatical concord issues create for both students and teachers.

Analysis of Issues Arising from Students’ Use of Grammatical Concord in the Selected Examination Scripts.

This paper focused on some four key areas in grammatical concord namely: (i) concord within tenses, (ii) subject-verb concord or agreement, (iii) concord with the relative pronouns, (iv) concord with certain phrases, expressions or words such as: as well as, in addition to, together with, including, along with, amongst others. Below, the paper presents and analyses an example of each grammatical concord challenge as identified from the selected examination scripts of the students.

1. Challenges students face when it comes to the use concord within tenses.

A look at the selected students’ examination scripts revealed the following sentence: The police left the scene of the accident after they took measurement of the place. It is obvious from the example that when it comes to the use of concord within tenses, students are not conversant with the rule, which stipulates that
whenever one wants to describe two events which occurred in the past, the correct tense to use is the past perfect. In addition, they tend to forget that the past perfect tense uses the auxiliary verb ‘had’ and the perfect form of any lexical verb. The correct sentence, which students should have written is, *the police left the scene of the accident after they had taken measurement of the place or after the police had taken measurement of the place of accident, they left (the place).*

2. Challenges associated with students’ use of subject-verb agreement.

As a response to a question: *State two usefulness of communication to human beings*, which appeared in one of the question papers, students provided the following answers: *Communication help human beings to spread information or It help human beings to spread information.* Indeed, this response from the students underscores the fact that they have not internalized the rule of subject-verb agreement. In other words, it is apt to argue that students find it difficult to identify the subject, especially when it is an abstract noun, and when the impersonal pronoun ‘it’ acts as a subject in sentences they construct.

3. Challenges students encounter when it comes to the use of concord with the relative pronouns.

The problem with the relative pronouns with regard to grammatical concord usage among students and indeed other users of ESL leaves much to be desired. From the selected scripts, students were asked to make a choice between certain verbs which were placed in brackets in some sentences as follows: *In Ghana, one of the challenges that (contribute/contributes) to the growth and development of the tourism sector is the fast food industry.* Only a few students were able to make the correct choice of verbs in the brackets to agree with the subject – antecedent – the challenges. The rest of the students chose the verb “contributes” instead. Indeed, the responses which the students gave clearly demonstrated their paucity of knowledge when it comes to issues regarding the rule of concord with the relative pronouns – which, that, who, whose, amongst others.

(4) Challenges students face with the use of concord with certain expressions or words such as: as well as, in addition to, together with, including and along with.

(Wiredu, 1998; Sekyi-Baidoo; 2003; Quagie, 2010) amongst others have argued, whenever the phrases or words as mentioned above are used to describe or modify a series of nouns and noun phrases, the verb should agree with the form of the first noun mentioned in order to achieve unity and coherence in grammatical concord. Guided by this principle, the researcher found from the selected students’ essay
scripts the violation of this grammatical rule as presented in the following extract: *My father, together with other younger siblings of mine, were conveyed to the hospital.*

Clearly, the extract from the selected students’ scripts has presented ample evidence that students are not comfortable with this grammatical rule as far as concord usage is concerned. In the example, the noun phrase ‘my father’ represents a singular noun; therefore, requires a singular verb ‘was’ instead of ‘were’.

**Findings**

**Research Question I: What is a grammatical concord?**

This question sought to ascertain the definition of the phrase ‘grammatical concord’ which is explained as a cordial relationship which should exist between words – subjects and verbs, phrases and clauses in order to achieve meaning in both oral and written communications. However, it has been discovered that students, teachers and indeed speakers of ESL, or third and forth language violate certain grammatical rules with regard to concord because they have not internalized the rules which govern this aspect of the English grammar.

**Research Question II: Why do students continuously face problems with the use of grammatical concord in English as a second language?**

This question wanted to investigate why grammatical concord continues to pose a challenge to students. From the discussions and analyses of the various extracts, it was realized that almost all the grammatical concord types identified in this study have posed some threat to the students because of the following factors: First, the students do not have adequate knowledge with regard to the use of the rules which govern grammatical concord; hence, the challenges. Secondly, students’ plight with the use of grammatical concord might be due to poor teaching pedagogies employed by some teachers of ESL, especially at the basic schools in Ghana and elsewhere. Finally, it is pertinent to reiterate the point that the problem of English grammar – concord, continues to haunt students because of the caliber of teachers who teach the subject or language in our schools, colleges and even universities. Indeed, it is pathetic to indicate that some teachers of ESL in some Ghanaian schools and colleges can best be described as square pegs in round holes.
Research Question III: What semantic problems are created when students violate the rules of grammatical concord?

The question sought to ascertain the semantics effects that are created when students violate the rule of concord in ESL. Semantics is a branch of linguistics which deals with meaning (Sekyi-Baidoo, 2002). It therefore stands to reason that meaning in ESL can be impeded when rules which govern how the language is spoken and written are not adhered to. From the analysis, it was obvious that ‘poor grammar obstructs communication and therefore meaning’ (Aloysius et al 1997:294). Indeed, when one considers students’ violation of the rule of concord within tenses as portrayed in example 1 of the analysis, there is no doubt that the sentence can present different shades of meaning as a result of wrong tense concord.

Conclusion and Recommendations

The paper has argued that grammatical concord as an aspect of ESL continues to pose challenges to both teachers and students in schools as a result of poor teaching pedagogies and the caliber of teachers who teach the language. The paper has therefore recommended that in order to ameliorate the problem of grammatical concord in ESL in Ghana and elsewhere, the teaching of the language should be intensified and modernized. For example, (Rinlucri, 1984; Swan, 1984; Yankson, 1994; Tsadidey, 2002) amongst others have argued that the various activities and methods which ESL teachers employ during teaching and learning should be suitable to the level of students and should be geared towards enhancing a particular grammatical skill in students. This assertion is a worthwhile one which needs to be taped into by ESL teachers. In addition, as a recommendation, the study would like to reiterate the earlier point with regard to the knowledge of the teacher of ESL. Teachers must be well trained and should be given regular in-service training to keep them abreast of the current developments in the discipline. More so, according to Tsadidey (1989), grammar has become an essential communicative tool; therefore, the pattern practice of teaching grammar – concord, should give way to practical discussion on how students can use grammar to communicate essential information. In this regard, the paper would like to argue unequivocally that teachers of ESL should Endeavour to read constantly in order to enhance their understanding of issues pertaining to the teaching of the subject. In fact, the paper has observed with grave concern that whenever it comes to teaching of grammatical concord, teachers merely ‘brush off the surface’ of the subject for students, and leave other complex issues such as concord with the relative pronouns, amongst others, still insurmountable to students; and I dare say that it is time teachers of ESL in Ghana, repositioned themselves in the discipline.
I believe when teachers and students practice properly how to master these rules, the problem of grammar would be a thing of the past.

Finally, as a word of admonition to students, they must cultivate the culture of reading good grammar books, which have discussed some challenging issues in grammatical concord and English grammar in general. For example, students should read grammar books such as: Better English through Concord for West African Students by Yankson (1994), English: A Tool for Communication for Universities and Tertiary Institutions by Quagie (2010) and Business English by Slocum (2004).

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SINGLE SUPPLY OF ELECTRICAL ENERGY IN THE SUPPLY DISTRIBUTION MODEL: USING GAMS TO MODEL THE EFFECTS OF NETWORK PARAMETERS

ON THE LEVEL OF CONSUMER DEMAND

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Abstract

The proposed model of this study is a single supply of electrical energy and is used in distribution systems. The objective of this study is to optimize the distribution of active and reactive energy in the supply of sub-distribution or the market. The model proposed in this paper accounts for the effects associated with switching capacitors on distribution and dispatching centers. Using capacitors in the power grid has an effect on bus voltage and consequently the amount of active and reactive energy demand of the consumer. The optimized supply is determined through the solution of a mathematical operation model. In this study, the effect of voltage changes on consumer demand for residential, commercial and industrial power are quantified and embodied in an analytical model, which is then solved using General Algebraic Modeling System (GAMS) software.

Keywords - The Next Day Market; Capacitor Switching; Single Supply of Electrical Energy; Distribution Consumption Model

I. Introduction

Modeling power consumption under the assumption of constant power in terms of network variables and disregarding the effect of network parameters has low accuracy; the low voltage change on the consumer’s bus has negligible effect on the amount of energy consumption. This incorrect modeling leads to inaccuracies in power supply analysis and prediction. The use of a more comprehensive model with the capability of taking into consideration the bus voltage is needed.
Conventional models such as constant active power, constant impedance, and the constant current and exponential models are some types of consumers which the effect of voltage on their consumption energy levels has been observed. New approaches have been offered for a more accurate modeling of consumption. Variable definition of the model is shown in Table 1.

The models that network variables such as voltage and frequency have been found in them. The complexity of the new models, conventional methods for solving them will not convex into an answer; since the results of these models are based on trial and error so the ability to make the model of all consumers is not possible. Therefore, this consumer model has been expressed with regard to this problem. In this model, voltage quality over consumption energy of loads has been considered. Since distribution companies in this final model are considered private corporations, so in this regard the optimum utilization of supply purpose is to maximize profits. Distribution of the proposed model will determine the demand of the market for the next day market, the voltage quality, and capacitor switching will be determined. The next day market is a market for supply planning for any time of the future day that will be formed with regard to load flow constraints. Unlike its name, it is usually a forecast which is done a few days before the actual date. Supply and demand in the market for each hour of t the next day have been presented in their proposals. In this model it is assumed the cost per unit of active and reactive power is independent of the demand model.

**Table 1: Variables Definition**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Type of Variable</th>
<th>Variable</th>
<th>Description</th>
<th>Type of Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>TotalRevenue</td>
<td>Total Revenue of distribution company in 24 hrs</td>
<td>Endogenous</td>
<td>q(t, type, i)</td>
<td>Predicted Reactive Energy per MVArh for the final consumer at bus i, group type, and time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>TotalCost</td>
<td>Total Cost of distribution company in 24 hrs</td>
<td>Endogenous</td>
<td>p_{pu}(t, type, i)</td>
<td>Predicted active energy Per MWh for the final consumer at bus i, group type, and time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Profit</td>
<td>Total Profit distribution company in 24 hrs</td>
<td>Endogenous</td>
<td>q_{pu}(t, type, i)</td>
<td>Predicted Reactive Energy per MVArh for the final consumer at bus i, group type, and time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>RC(t, i)</td>
<td>Income from the sale of electricity to consumers in bus i at time t</td>
<td>Endogenous</td>
<td>PM(t)</td>
<td>Purchase cost per unit of reactive power from the wholesale market in terms of $\frac{\delta}{MWh}$ at time t</td>
<td>Exogenous</td>
</tr>
<tr>
<td>ca(t, type)</td>
<td>Active energy per unit ($\frac{\delta}{MWh}$) sales price to the final consumer in group type and time t</td>
<td>Exogenous</td>
<td>QM(t)</td>
<td>Purchase cost per unit of reactive power from the wholesale market in $\frac{\delta}{MVArh}$ terms of at time t</td>
<td>Exogenous</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Type of Variable</td>
<td>Variable</td>
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</tr>
<tr>
<td>cr(t, type)</td>
<td>Reactive energy per unit sales price to the final consumer in type and time t</td>
<td>Exogenous</td>
<td>CM(t)</td>
<td>Purchase cost from the wholesale market at time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>p(t, type, i)</td>
<td>Predicted Active Energy Per MWh for the final consumer at bus i, type and time t</td>
<td>Endogenous</td>
<td>Vpu(i)min</td>
<td>The minimum permissible bus voltage in bus i in per unit</td>
<td>Exogenous</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Type of Variable</td>
<td>Variable</td>
<td>Description</td>
<td>Type of Variable</td>
</tr>
<tr>
<td>Vpu(t)max</td>
<td>The maximum permissible bus voltage in bus i in Per unit</td>
<td>Exogenous</td>
<td>Qpos Slack(t)</td>
<td>the proposed reactive power for purchase from an external market at time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Vpu(t)max</td>
<td>The maximum permissible bus voltage in bus i in Per unit</td>
<td>Exogenous</td>
<td>Qneg Slack(t)</td>
<td>the proposed reactive power for sale to an external network or a market at time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Vpu,Stack,Constant</td>
<td>Voltage of Slack per unit</td>
<td>Exogenous</td>
<td>Pstack(t)</td>
<td>Traded Active Energy in distribution companies to wholesale market at time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Vpu(t, i)</td>
<td>Voltage of Bus i at time t in Per unit</td>
<td>Endogenous</td>
<td>Qstack(t)</td>
<td>Traded Reactive Energy in distribution companies to wholesale market at time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Ypu(i, j)</td>
<td>Size of Entries in row i and column j of admittance matrix based on Per unit</td>
<td>Endogenous</td>
<td>Pmax Stack(t)</td>
<td>Maximum reactive power can be purchased from the wholesale market at time t</td>
<td>Exogenous</td>
</tr>
<tr>
<td>δ(t, i)</td>
<td>Voltage angle of bus i at time t</td>
<td>Exogenous</td>
<td>θ(i, j)</td>
<td>Angle element in row i and column j of the matrix Admittance</td>
<td>Exogenous</td>
</tr>
<tr>
<td>f</td>
<td>System frequency</td>
<td>Exogenous</td>
<td>NCap(i, t)</td>
<td>Number of capacitors connected to bus i at time t</td>
<td>Endogenous</td>
</tr>
<tr>
<td>Spu,cap(t, i)</td>
<td>Injected reactive power of bus i at time t in per unit</td>
<td>Endogenous</td>
<td>NCap_max(i)</td>
<td>Maximum number of capacitor on bus i</td>
<td>Exogenous</td>
</tr>
<tr>
<td>Cpu,base(i)</td>
<td>Capacitors connected to bus i at time t based on per unit</td>
<td>Exogenous</td>
<td>Reg Stack(t)</td>
<td>Value of Proposed Active Energy for sale from an external grid or a market at time t</td>
<td>Endogenous</td>
</tr>
</tbody>
</table>
II. The model

The proposed model is an energy supply model, and therefore consists of the objective function and constraints. In Section II-A, the objective function and the method which the objective model was defined are discussed and in section II-B, the constraints and the method which the model was modeled are discussed.

A. Objective Function

With the renewal of the power structure in the main stimulus to motivate companies to reduce losses of distribution network, earn higher profits because the companies of distribution has a private nature, so the company will aim to increase profits and decrease losses of the network therefore, increase the final cost of electricity distribution companies to increase compelling interest to optimize utilization of network, and therefore it results in reducing losses. However, according to the aim of companies, the minimum loses does not guaranteed to have maximum profit. Therefore, the proposed model objective function is to maximize total profits in 24 hours forecasting window (Garg and Sharma 2008, Kirschen et. al 2004). Distribution of profit per hour was a total difference in cost and revenue, and it is obtained using equation (1) model.

\[
Profit = Total\ Revenue - Total\ Cost
\]  

The source of Income for distribution companies in an hour, which is selling electricity to consumers using equation (2), is calculated.

\[
Total\ Revenue = \sum_{t=1}^{24} \sum_{i=2}^{N} RC(t, i)
\]  

Income from energy sales to consumers is comprised of two parts. The first is the energy sale of active power and the second is reactive power sale. Energy cost per hour for each group of consumers can be different. In this model it is assumed that each bus has a same type of consumption. Using equation (3) the cost for the bus “i” and time” t” is modeled.

\[
RC(t, i) = ca(t, type) \cdot p(t, type, i) + cr(t, type) \cdot q(t, type, i)
\]  

Distribution cost in the electricity market is a time cost of purchasing, and using equation (4) is modeled.

\[
TotalCost = \sum_{t=1}^{24} CM(t)
\]  

In this model, it is assumed that the purchase cost per unit of electrical energy market, is an independent variable. Purchase cost of the network at any time using equation (5) is modeled. This relationship consists of two cost functions, the first part is associated with purchase cost of the active power, and the second part is associated with purchase cost of the reactive power.
B. Constraints

The constraints used here include load flow constraints, each bus voltage, and performance capacitor in network. Usually the node voltage method that is most suitable for power system analysis is used for formulation of network equations. This type of load flow is used for calculating the exact amount of the loss voltage in the distribution lines and also for increasing the accuracy of calculation.

For modeling constraints equation (6) and (7) are used. These equations represent the balance between generation and consumption.

\[
\frac{-q_{pu}(t, \text{type, } i)}{1 \text{ hr}} + \frac{Q_{pu,cap}(i, t)}{1 \text{ hr}} = \sum_{j=1}^{NB} V_{pu}(t, i) \cdot V_{pu}(t, j) \cdot \sin(\delta(t, i) - \delta(t, j) - \theta(i, j))
\]

\[
\frac{-p_{pu}(t, \text{type, } i)}{1 \text{ hr}} = \sum_{j=1}^{N} V_{pu}(t, i) \cdot V_{pu}(t, j) \cdot Y_{pu}(i, j) \cdot \cos(\delta(t, i) - \delta(t, j) - \theta(i, j))
\]

In Equation 6 & 7, Y represents an impedance of the line. Distribution Lines based on the voltage and the type (aerial, cable, etc.) will be classified in three models that include:

- short distribution lines
- medium distribution lines
- long distribution lines

If the line length is less than about 80 km (50 miles) or the voltage is not more than 69 KV, the line capacitance can be neglected without much error, and the short line model can be used. Since the length of the distribution lines is less than 80 km and the distribution voltage level is less than kV 69, so short-line distribution model is used in this study.

a) Classification of Load Consumption:
In this model, three categories of consumers, industrial, commercial and residential have been divided.

b) Distribution Load Modeling:

Typically frequently changing voltage causes the power consumption of most of loads to be changed. Hence the constant power load model can reduce the accuracy of the model (Liu et.al 2002 and Singh et.al 2009).

In this paper to model the relationship between active power and reactive power of load with its voltage, equations (8) and (9) are used. Also it is possible with these equations to classify the loads into one of these four groups: constant current (I), constant impedance (Z), constant power (P&Q) and the exponential model (Saadat 2002).

Constant Current (I) model: characterized by the constant current over the input voltage to the load even if the voltage of the node is changed, but by changing the voltage of the node, the power load changes. In this model the load power consumption is proportional to the size of the load voltage varies.

Constant Impedance model (Z): In this model, if the node voltage is changed, load impedance remains constant. Through specification is used to gain power consumption. The power consumption of these groups varies with the square of the load voltage.
Constant Power Model (P&Q): In this model if the node voltage is changed, the load power remains constant and also the change in level of node voltage, the current changes is in such a way that an input power supply is needed.

Exponential load model: the load power consumption varies exponentially with voltage measurements.

\[ P = P_0 \cdot V^{K_1} \]  \hspace{1cm} (8)

\[ Q = Q_0 \cdot V^{K_2} \]  \hspace{1cm} (9)

The amount of active power and reactive power \( P_0 \) and \( Q_0 \) is at the nominal voltage and \( V \) is the voltage in the per unit system. \( K_2 \) and \( K_1 \) are also not required to be equal and the amount of active power and reactive power can be sensitive to voltage changes at different values. Coefficients \( K_1 \) and \( K_2 \) are not available due to lack of information for most loads characteristics and the distribution companies do not have information about the type of loads, so the loads have been classified into four groups and then the values of \( K_2 \) and \( K_1 \) are the selective use.

In this case the coefficient \( K_2 \) and \( K_1 \) for each group according to Table 2 will be selected.

TABLE 2: K1 AND K2 VALUES FOR THE FOUR CATEGORIES OF CONVENTIONAL DISTRIBUTION LOADS

<table>
<thead>
<tr>
<th>Classification of Load Power</th>
<th>( K_2 = K_1 = 0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant Current (I)</td>
<td>( K_2 = K_1 = 1 )</td>
</tr>
<tr>
<td>Constant Impedance Model (Z)</td>
<td>( K_2 = K_1 = 2 )</td>
</tr>
<tr>
<td>Exponential Model</td>
<td>( K_2 = 3.22, K_1 = 1.38 )</td>
</tr>
</tbody>
</table>

\( K_1 \) and \( K_2 \) values for each load based on using data from laboratory or experimental curve is obtained.

For the sample, Table 3 determines the coefficient \( K_1 \) and \( K_2 \) based on the classification of load consumptions.

TABLE 3: K1 AND K2 VALUES FOR THE CLASSIFICATION OF LOAD CONSUMPTIONS

<table>
<thead>
<tr>
<th>Classification of Load Consumptions</th>
<th>( K_1 )</th>
<th>( K_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>0.18</td>
<td>6</td>
</tr>
<tr>
<td>Residential</td>
<td>0.92</td>
<td>4.04</td>
</tr>
<tr>
<td>Commercial</td>
<td>1.51</td>
<td>3.04</td>
</tr>
</tbody>
</table>
c) **The Bus Voltage Limit:**

For proper functioning of equipment and distribution system efficiency, the bus voltage should be in allowed range. In a natural system, the maximum and minimum voltage must not exceed 10% ± range. Thus, using the equation (11), the excessive increase or decrease of voltage is prevented. Equation (10) is the voltage of sub-distribution system that is used as the reference voltage and the voltage value depends on no other buses.

\[
V_{pu}(1,t) = V_{pu,Slack,Constant} \tag{10}
\]

\[
V_{pu}(i)_{min} \leq V_{pu}(t,i) \leq V_{pu}(i)_{max} \tag{11}
\]

Since load of each buss is sensitive, acceptable efficient voltage range of the amount permitted to be located at each bus voltage of each bus in the system unit can be defined differently.
d) Capacitance Constraint

One of conventional and low-cost ways of providing reactive power is using capacitor. Thus in this section this model is discussed. The capacitor which is connected to the network is of type the parallel, and capacitor banks can be formed with a base value with a few capacitors. The amount of reactive power injected by the capacitor bank into the network in this model the equation (12) can be used.

\[ Q_{pu,\text{cap}} = -V_{pu}(i,t)^2(2f\pi)(N\text{Cap}(i,t)C_{pu,\text{base}}(i)) \]  

(12)

The number of capacitors in network at any time shall not be more than the total capacitance of capacitor bank, and also the correct numerical value must be an integer and nonnegative. Equation (13) and (14) are the expression of these constraints.

\[ 0 \leq N\text{Cap}(i,t) \leq N\text{Cap}_{\text{max}}(i) \]  

(13)

\[ N\text{Cap}(i,t) : \text{Integer} \]  

(14)

III. The software Solution

Nature of functions and equations in this model are nonlinear models with integer variables, and to obtain the optimal solution two methods can be used. The first approach is to make the functions linear. Then the use of conventional methods of mathematical operational research and the second method is selecting the appropriate method for solving such a problem like this.

Since to make the functions and equations linear which are used in this non-linear model, is complicated, and also is associated with reduced accuracy of the method for solving the proposed model, the second approach is used to solve the problem, so GAMS software has been selected for solving this problem.

IV. Sampling

The results of the model in this section go to the part of electricity distribution network feeder of Khodabandelu district in Tehran. Single-line diagram in Figure 1 is depicted.

In this network a 20 kV feeder with 13 buses from substation 20/63 KV is studied. Impedance profile lines are shown in Table 3. This information network has been extracted from reference (Khaje Kazeruni 2001).
Also, 3 capacitors on the buses 10, 12 and 13 are considered, and the profile of them in the distribution network in Table 6 is shown.

Due to the unavailability of electrical energy consumption per hour at each bus of a feeder, and also according to the fact that in which classification (industrial, residential and commercial) the load is defined, the amount of energy consumption in the distribution network has been studied in two cases. Line characteristic in Table 4 and Classification of the loads and the peak consumption in Table 5, and Table 6 are considered.

**TABLE 4: THE LINE CHARACTERISTICS (IMPEDANCES)**

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>R</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>0.176</td>
<td>0.138</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0.176</td>
<td>0.138</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0.045</td>
<td>0.035</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0.089</td>
<td>0.069</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>0.045</td>
<td>0.035</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>0.136</td>
<td>0.091</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>0.073</td>
<td>0.073</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>0.074</td>
<td>0.058</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>0.093</td>
<td>0.093</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>0.063</td>
<td>0.05</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>0.068</td>
<td>0.053</td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>0.062</td>
<td>0.053</td>
</tr>
</tbody>
</table>

In the first case, all the consumers in the network are considered with a constant power and in the second case; each consumer is modeled with its corresponding load classification.

**TABLE 5: THE LOAD CONSUMPTION CLASSIFICATION AND PEAK LOAD**

<table>
<thead>
<tr>
<th>Peak Load</th>
<th>P (pu)</th>
<th>Q (pu)</th>
<th>Type of Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ni2</td>
<td>0.089</td>
<td>0.0468</td>
<td>Industrial</td>
</tr>
<tr>
<td>ni3</td>
<td>0.0628</td>
<td>0.047</td>
<td>Industrial</td>
</tr>
<tr>
<td>ni4</td>
<td>0.111</td>
<td>0.0767</td>
<td>Industrial</td>
</tr>
<tr>
<td>ni5</td>
<td>0.064</td>
<td>0.0378</td>
<td>Industrial</td>
</tr>
<tr>
<td>ni6</td>
<td>0.047</td>
<td>0.0344</td>
<td>Residential</td>
</tr>
<tr>
<td>ni7</td>
<td>0.134</td>
<td>0.1078</td>
<td>Industrial</td>
</tr>
<tr>
<td>ni8</td>
<td>0.092</td>
<td>0.0292</td>
<td>Commercial</td>
</tr>
<tr>
<td>ni9</td>
<td>0.077</td>
<td>0.0498</td>
<td>Commercial</td>
</tr>
<tr>
<td>ni10</td>
<td>0.066</td>
<td>0.048</td>
<td>Commercial</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>ni11</td>
<td>0.069</td>
<td>0.0186</td>
<td>Residential</td>
</tr>
<tr>
<td>ni12</td>
<td>0.129</td>
<td>0.0554</td>
<td>Commercial</td>
</tr>
<tr>
<td>ni13</td>
<td>0.112</td>
<td>0.048</td>
<td>Residential</td>
</tr>
</tbody>
</table>

**TABLE 6: THE PERCENTAGE OF PEAK CONSUMPTION OF ENERGY IN REGARDING WITH EACH CLASSIFICATION**

<table>
<thead>
<tr>
<th>T</th>
<th>Commercial</th>
<th>Industrial</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>10</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>T2</td>
<td>2</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>T3</td>
<td>2</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>T4</td>
<td>2</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>T5</td>
<td>2</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>T6</td>
<td>10</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>T7</td>
<td>10</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>T8</td>
<td>20</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>T9</td>
<td>60</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>T10</td>
<td>90</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>T11</td>
<td>100</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>T12</td>
<td>100</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>T13</td>
<td>100</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>T14</td>
<td>100</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>T15</td>
<td>100</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>T16</td>
<td>90</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>T17</td>
<td>90</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>T18</td>
<td>90</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>T19</td>
<td>100</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>T20</td>
<td>100</td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>T21</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>T22</td>
<td>90</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>T23</td>
<td>80</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>T24</td>
<td>30</td>
<td>40</td>
<td>90</td>
</tr>
<tr>
<td>T25</td>
<td>10</td>
<td>40</td>
<td>70</td>
</tr>
</tbody>
</table>

**TABLE 7: THE SIZE AND NUMBER OF CAPACITOR IN DISTRIBUTION NETWORK**

<table>
<thead>
<tr>
<th>Size of Capacitor (µF)</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>ni10</td>
<td>2</td>
</tr>
<tr>
<td>ni12</td>
<td>2</td>
</tr>
<tr>
<td>ni13</td>
<td>2</td>
</tr>
</tbody>
</table>
V. Conclusion

More accurate model of the load consumption continues to increase the accuracy of demand the model but also, run time to solve the model by the software will be prolonged. This model can be used to compare the effect of the load demand of the market for wholesale distribution companies or sub-distribution’s bus.

VI. References


A HYBRID DISCRETE FAST FOURIER TRANSFORM ELLIPTICAL CRYPTOGRAPHIC ALGORITHM FOR PORTABLE WIRELESS DEVICES AND DISTRIBUTED NETWORKS

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ABSTRACT
The Discrete Fourier Transform (DFT) Method useful for a wide variety of scientific applications, also provides a highly efficient process for the multiplication of m-bit integer degree polynomials resulting in the best known asymptotic complexity to date, i.e. $O(m \log m \log \log m)$. In this paper, we propose a new Hybrid Prime Number Factoring DFT algorithm to increase the speed of the HOOD CRYPT Elliptical cryptographic method we described in an earlier paper [3]. Our hybrid method, an improvement of the HOOD CRYPT method, compares well against the fastest known prime factoring algorithms i.e. the Pollard-Strassen method [1] and Quadratic-Sieve [1].
The HOOD CRYPT algorithm based on a matrix of elliptical equations divided on the basis of Orthogonal Frequency Division Multiplexed (OFDM) channels can be implemented on single nodes or in a distributed node environment. Furthermore, the Hybrid Prime Number Factoring Algorithm which incorporates the Pollard-Strassen and Quadratic-Sieve methods, can also be subdivided into subtasks accomplished using cooperating processors or sensor networks such as in Distributed (Radio Frequency Identification) RFID applications.

We combine the advantages of the HOOD CRYPT algorithm with the benefits of the new Hybrid Prime Number Factoring DFT Algorithm to create a powerful, compact, efficient and extremely fast encryption scheme while still retaining the intractability of inverse computation if a priori knowledge of certain parameters is ruled out.

We tested this algorithm up to the 29th prime using four different wireless handheld device simulators namely the Windows Mobile HTC Simulator, Sony Ericsson’s Openwave Simulator, Blackberry RIM’s MIDP JDE Simulator from Net Beans and the iPhone SDK simulation framework from MAC. We built the algorithm using the NETBEANS integrated environment. The results show fast and efficient simulation performance on the Black Berry RIM and the Sony Ericsson Simulators while mixed results were found in the Windows Mobile and iPhone Simulators possibly due to the authentication control already existing in them. This algorithm can be applied in digital signatures, security certificates and encryption schemes for a wide variety portable wireless devices and distributed networks.
1. INTRODUCTION

From earlier work we have done [3], we will use the following definitions to lay the groundwork for the DFT method.

"An Elliptical curve may be defined as an equation of the form \( ay^2 + bxy = cx^3 + dx^2 + ex + f \), where \( a, b, c, d, e, f, x \) and \( y \) are for cryptographic purposes restricted to each belong to a finite field i.e. \( a, b, c, d, e, f, x \) and \( y \) are each chosen from a distinct set of integral values [2, 10].

The Elliptical curve provides desirable properties of simple and straightforward encryption computation. The inverse operation is intractable and very difficult to compute [4]. We can define a rule for adding two points \( S_1 \) and \( S_2 \) on the curve to find a third point \( S_3 \). These points are all on the curve thus forming an Abelian group [4]. The trivial case of infinity also needs to be included. The order of the curve is defined as the number of distinct points which satisfy this condition including the infinity point as follows:

\[
\prod_{t=1}^{m} S_t = \sum_{t=1}^{m} S_t
\]

\( S_1 = S_1 + S_2, \quad S_4 = S_1 + S_2, \quad S_3 = S_1 x S_2, \quad S_4 = S_1 x S_2 x S_3 \)

If we set \( b = 0 \) in the equation \( ay^2 + bxy = cx^3 + dx^2 + ex + f \) i.e. \( ay^2 = cx^3 + dx^2 + ex + f \), with conditions:

(i) \( 4a^3 + 27b^2 \neq 0 \)

(ii) \( b \neq 0 \)

The Discrete Logarithm Problem: At the foundation of every cryptosystem is a hard mathematical problem that is computationally almost infeasible to solve [3]. The discrete logarithm problem is the basis for the security of many cryptosystems including the Elliptic Curve Cryptosystem (ECC). Specifically, ECC relies on the difficulty of Elliptic Curve Discrete Logarithm Problem (ECDLP). There are two geometrically defined operations over certain elliptic curve groups. These two operations are point addition and point doubling. By selecting a point in an elliptic curve group, one can double it to obtain the point \( 2S \). After that, one can add the point \( S \) to the point \( 2S \) to obtain the point \( 3S \). The determination of a point \( mS \) in this manner is referred to as Scalar Multiplication of a point. The ECDLP is based upon the intractability of scalar multiplication products. In the multiplicative group \( I_p \), the discrete logarithm problem is:

Given elements \( r \) and \( q \) of the group, and a prime \( p \), find a number \( k \) such that \( r = qk \) mod \( p \). If the elliptic curve group is described using multiplicative notation, then the elliptic curve discrete logarithm problem is:

Given points \( S_1 \) and \( Q \) in the group, find a number that \( S_1 k = Q \); \( k \) is called the discrete logarithm of \( Q \) to the base \( P \). When the elliptic curve group is described using additive notation, the elliptic curve discrete logarithm problem is:

Given points \( P \) and \( Q \) in the group, find a number \( k \) such that \( S_1 k = Q \). It is widely believed that the elliptic curve discrete logarithm problem is hard to computationally solve when the point \( P \) has large prime order. The known methods for solving the ECDLP are [2]:
The Pohlig-Hellman algorithm (which reduces the problem to subgroups of prime order).


Pollard’s methods (especially the parallel Pollard method of van Oorschot and Wiener).

The Menezes-Okamoto-Vanstone (MOV) attack using the Weil pairing.

The Frey-Rueck attack using the Tate pairing.

The attacks on anomalous elliptic curves (i.e., elliptic curves over $\mathbb{F}_p$ which have $p$ points) due to Semaev, Satoh-Araki and Smart and Weil descent (for some special finite fields) [3].

2. THE ADVANTAGES OF DISCRETE FOURIER TRANSFORM (DFT)

Discrete Fourier Transform (DFT) algorithms have many applications. Signal communications systems use DFTs to encode analog signals digitally by sampling the signal at given intervals and digitizing them in order to capture the sinusoidal wave patterns. One such application is in Orthogonal Frequency Division Multiplexing (OFDM) used in the WiMax protocol. OFDM is a subset of frequency division multiplexing in which a single channel uses multiple sub-carriers on adjacent fields. The sub-carriers overlap to maximize spectral efficiency. Overlapping sub-carriers usually results in interference, but orthogonality ensures that the overlap occurs with minimal interference [5, 6, 7].

![Fig. 1: Secure Wireless Communications.](image)

To secure such applications, it is often necessary to encrypt the digitized signal during the capture, transmission and reception and storage process. Consider the Fourier transform of a continuous-time signal $X(w)$ defined as:

$$
X(w) = \int_{-\infty}^{\infty} x(t) e^{-jwt} dt, \ w \in (-\infty, \infty).
$$

The Discrete Fourier Transform DFT, on the other hand, approximates and replaces the infinite integral with a finite sum given by:

$$
X(w_k) \approx \sum_{n=0}^{N-1} x(t_n) e^{-j\omega_k t_n}, k = 0, 1, 2, \ldots, N-1.
$$

$$
\sum_{n=0}^{N-1} f(n) \approx f(0) + f(1) + f(2) + \ldots + f(N-1)
$$
where

\( x(t_n) \) is input signal amplitude (real or complex at time \( t_n \) (sec)),

\( t_n = nT = \text{nth sampling instant (sec)}, n, \text{ integer } \geq 0, \)

\( T \) is sampling interval (sec),

\( X(\omega_k) \) is spectrum of \( x \) (complex valued), at frequency \( \omega_k \),

\( W_k = k\Omega = k\text{th frequency sample (radians per sec)}, \)

\( \Omega = \frac{2\pi}{NT} = \text{radian frequency sampling interval (rad/sec)}, \)

\( f_s = \frac{1}{T} = \text{sampling rate (Hz)}, \)

\( N \) is number of time samples = no. of frequency samples.

We can express the equation in terms of \( x(t_n) \) using recursive function theory as with shown with \( f(n) \).

The inverse DFT (the IDFT) is given by

\[
X(t_n) = \frac{1}{N} \sum_{K=0}^{N-1} X(\omega_k)e^{-j\omega_k t_n}, \quad n=0,1,2,\ldots,N-1.
\]

\( j = \sqrt{-1} \)

\( e = 2.71828182845905\ldots \)

Using Euler’s Identity,

\[
x_k(t_n) \approx e^{j\omega_k t_n} = \cos(\omega_k t_n) + jsin(\omega_k t_n).
\]

The advantage of the DFT is its computational ease and flexibility allowing us to stretch the computation according to the computing power of the device being used. Furthermore, the properties of linearity, conjugation and symmetry are maintained with respect to the time and frequency relationship in the equation [1].

3.0 THE QUAD-SIEVE ALGORITHM

The Quadratic Sieve, hereafter simply called the QS, was invented by Carl Pomerance in 1981, extending earlier ideas contributed by Kraitchik and Dixon [1]. The QS was the fastest known factoring algorithm until the Number Field Sieve algorithm (NFS) was discovered in 1993 [1]. Still the QS is faster than the Number Field Sieve for numbers up to 110 digits long. The QS Algorithm can be summarized as follows:

\( (i) \) If \( n \) is the prime number, the QS attempts to find two numbers \( x \) and \( y \) such that

\[
x \neq (+/-) y \pmod{n} \quad \text{and} \quad x^2 \neq y^2 \pmod{n}.
\]

\(
\Rightarrow (x - y)(x + y) = 0 \pmod{n}.
\)

\(
\Rightarrow \text{Compute } (x - y, n) \text{ using the Euclidean Algorithm [1].}
\)

\( (iii) \) Check to see if this is a non trivial divisor. If this is the case, define

\[
Q(x) = x + \left\lfloor \sqrt{n} \right\rfloor - n.
\]

\( (iv) \) Compute

\[
Q(x_1), Q(x_2), Q(x_3), \ldots, Q(x_k) \text{ s.t } Q(x_1)Q(x_2)Q(x_3) \ldots \quad (Q(x_k) = y^2, \quad \text{where } y^2 \text{ is such that largest } y^2 < n.
\]

\( (v) \) Iterate repeatedly till \( x_1, x_2, x_3, \ldots, x_r \) are the prime factors of \( n \).

A key consideration is to ensure efficient determination of the \( x_i \)’s such that \( Q(x_i) = y^2 \).

A base case set \( B \) of prime numbers \( P \) can be used to determine this provided we choose
\[ P = \{p_1, p_2, p_3, \ldots, p_k\} \text{ such that } n/p=1 \text{ for the } x \text{ values.} \]

### 4.0 THE NUMBER FIELD SIEVE ALGORITHM

The Number Field Sieve Algorithm (NFS) is a variation of the Quad-Sieve (QS) Algorithm. Their key difference between the two algorithms is that the Number Field Algorithm takes advantage of the Chinese Remainder Theorem to reduce the number of iterations used to compute \( Q(x) \) values while in the case of the Quad Sieve Algorithm, a longer method is used [1].

The Number Field Sieve Algorithm can be summarized as follows:

(i) Let \( n \) be the prime number.

(ii) Let \( m = \text{floor} \ (n/d) \).

(iii) We can write

\[
   n = c_d m^d + c_{d-1} m^{d-1} + \ldots + c_1 m + c_0
\]

Where \( 0 \leq c_i < m \)

(iv) Using the Chinese Remainder Theorem which states that if \( p_1, p_2, \ldots, p_k \) are distinct prime numbers and \( x_1, x_2, \ldots, x_k \) is a set of integers,

Given \( P = \prod p_i, i=1, k \),

With \( a_i = p_i^{-1} \text{ mod } p_i \)

Then \( y = \sum a_i x_i p_i \text{ mod } p \) is unique for \( i=1, 2, \ldots, k \)

And \( x = x_i \text{ (mod } p_i) \) for all \( i \).

\[ y/p = \sum a_i x_i, p_i /P = \sum a_i x_i /p \text{ for } i=1, k \]

From this point on, a simple GCD operation yields the \( x_i \) prime factors of \( n \).

### 5.0 THE HYBRID DFT ELLIPTICAL ALGORITHM

In order to implement the Hybrid DFT Elliptical Algorithm, we adapted the HOODCRYPT [3] model we developed earlier to include the DFT and QUAD-SIEVE/NUMBER FIELD SIEVE algorithms. The figure below illustrates the design. This algorithm can be implemented in both wireless and fixed line networks [3, 5, 6].

For the Encryptor, we had many choices to yield a powerful encryption scheme. Our implementation used the following approach:

Consider the elliptical curve equation introduced in section 1.0.

i.e. \( ay^2 + bzy = cz^3 + dz^2 + ez + f \).
Fig. 2: Modified HOODCRYPT DFT-Elliptical Encryption Scheme

We can encrypt the DFT signal by combining the DFT equation in section 2 with the Elliptical curve equation in section 1 as follows:

\[ X_E(w) = \sum \sqrt{\left(\frac{cz^2 + dz^3 + ez - bzy}{a}\right)}x(t) e^{-jwtk} \]

This equation is the foundation of the Hybrid DFT Elliptical curve algorithm. The

6.0 IMPLEMENTATION OF THE MODIFIED HOODCRYPT DFT ELLIPTICAL ENCRYPTION SCHEME.

Below is a description of each of the simulation environments used during the implementation process:

6.1 The Symbian Simulation Environment.

The first simulation environment we examined was Symbian which is used with the Palm series mobile devices. It is a proprietary operating system, designed for mobile devices, with associated libraries, security, user interface frameworks and reference implementations for common tools, produced by Symbian. It is a descendant of Psion’s environment. Detailed description of this system can be found in the Netbeans Wireless Simulation Package [8, 9]. Fig. 3 below illustrates the architecture of the Symbian framework. The Symbian Environment has many proprietary features which tended to make implementation a little more difficult.

Fig. 3: The Symbian Architecture

This led to a continuation of the use of servers; a microkernel; a request and callback approach to all services; an absolute division of user interfaces from system or application services; reuse and openness; extensibility; robust management and resource recovery to support on demand operation [8, 9].

6.2 The Windows Mobile HTC Simulator

The next simulator we examined was Windows Mobile HTC Simulation environment, which is widely used with HTC model phones. Windows Mobile is a compact operating system combined with basic applications for mobile devices based on the Microsoft Win32 API. Devices that run Windows Mobile include Pocket PCs, Smart phones, Portable Media Centers, and on-board computers for certain automobiles. It is designed to be similar to desktop versions of Windows and works with
Windows CE as well. Fig. 5 below shows the architecture.

The Windows Mobile HTC Architecture Windows Mobile has been updated several times, with the current version being Windows Mobile 6, and a new release scheduled for 2010. Further details about this simulation environment can be obtained from the Netbeans JDE wireless programming module [8, 9].

6.3 Sony Ericsson and Nokia Simulators

Openwave is a Windows-based application that you can use to design and simulate the operation of a wireless device right from conception through alpha and beta deployment. The simulator includes among other things, a TCP/IP simulation module, a Graphics Engine, Coding windows, functionality, user interface animators, browser and messaging. The architecture is shown below.

Fig. 5: The Windows Mobile HTC Simulator.

Openwave application code can be used to simulate real mobile phones made by Sony Ericsson and Nokia. The release of the Phone Simulator that was used in this project for testing includes a configuration file, or "skin," for an idealized, generic mobile phone. The figure below shows the architecture of Nokia’s Openwave Simulator [8, 9].

6.4 RIM Blackberry's JDE Simulator

The Blackberry Java Development Environment (Blackberry JDE) is a fully integrated development environment and simulation tool for building Java Micro Edition applications for Java based Blackberry smart phones. The figure below illustrates the main features of the Blackberry JDE Simulator. Fig. 6 below illustrates the main features.

Fig. 6: Blackberry JDE Simulator.
The Blackberry Simulation Framework covers the design process comprehensively. It is also a Mobile Information Device Profile (MIDP) that is compliant with Java ME environment for developers who wish to maintain portability in their wireless applications. In addition, the Blackberry JDE provides a full set of interfaces and utilities to take advantage of some of the features of the Blackberry smart phone [8, 9].

7.0 COMPARATIVE ANALYSIS OF THE QUAD SIEVE AND NUMBER FIELD ALGORITHMS

We implemented this scheme on four different wireless systems simulators namely the Symbian Palm Series Operating System Simulator, the Windows Mobile HTC Simulator, the SONY Ericsson OPENWAVE Simulator and the RIM Blackberry MIDP JDE Simulator. Each of these Simulation Environments was readily programmable in Java enabling us to implement the same algorithm seamlessly using the Netbeans Java Development Environment [8-14]. The systems however varied in the way they processed signals beyond the Fourier Transformation and Encryption stage. We are currently running tests on the encryption scheme to compute the inverse for up to the 29th prime number for the Quad Sieve and Number Field Sieve Algorithms on the Windows Mobile HTC, Symbian, Openwave and Blackberry JDE Simulators respectively. Preliminary results indicate that the Quad Sieve algorithm outperforms the Number Field Sieve Algorithm for up to the 29th prime [15-18].

We hope to conduct tests on the using CRYPTOOL which allows accurate measurement of algorithm performance. This has not yet been incorporated. The preliminary results show fast and efficient performance on the Black Berry JDE and the Openwave Nokia environment. There are still a few bugs in the Windows Mobile simulation while we have not yet succeeded in implementing the algorithm in the iPhone SDK simulator.

8. CONCLUSION

The simulation of the Quad Sieve and Number Field Sieve using the DFT scheme provides a fast and secure method of encoding digitized signals. We combine the advantages of the HOOD CRYPT algorithm with the benefits of the new Hybrid Prime Number Factoring DFT Algorithm to create a powerful, compact, efficient and extremely fast encryption scheme while still retaining the intractability of inverse computation without prior knowledge of certain parameters.

The Quad Sieve Algorithm has a running time of approximately $O(e^{\sqrt{1.25\ln(n).\ln(\ln(n))}})$. Using Gaussian elimination techniques, the running time can be reduced to $O(e^{\sqrt{\ln(n)\ln(\ln(n))}})$. The Number Field Sieve Algorithm on the other hand yielded a running time of approximately $O(e^{1.9223{(\ln(n)1/3.\ln(\ln(\ln(n))2/3)}})$. The Quad Sieve Algorithm outperforms the Number Field Sieve algorithm for smaller values of $p$. The Number Field Sieve algorithm is clearly better for the 110th prime and above. It would therefore be better to mix the two algorithms based on the $P$ values. In comparison, the Pollard Strassen algorithm has a running time of $O(e^{N1/4})$. Both the Quad Algorithm and Number Field Sieve Algorithm out perform it.

The approach we used took advantage of the fact that the Quad Sieve Algorithm has the fastest running time for Prime Number factoring up to the 109th prime. The Number
Field Sieve Algorithm becomes exponentially faster than the Quad Sieve Algorithm after the 110th prime number. Combining the two algorithms as a hybrid yields the fastest algorithm for all prime number factoring applications. Using the Euler transform of the continuous signal FFT, the summation algorithm more efficiently encodes signals than traditional Fast Fourier algorithms.

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9. REFERENCES


TERRORISM IN AFRICA:
THE COLLISION OF CULTURE AND IDEOLOGY

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Abstract

The war on terrorism at home and abroad escalated with the 9/11 events. One important question which has been the subject of intense and ongoing study is what triggers, and how certain individuals are led, to, participate in acts of terrorism. The Department of Homeland Security policies require that security personnel anticipate and understand how extremists who commit acts of terrorism think, coordinate their plans and execute them. A necessary starting point is to understand the culture, ideology and terrorism nexus of its perpetrators. This paper examines terrorism and some fundamental theories that may explain the phenomenon of recruitment and radicalization. The Northern States of Africa will be presented as model for this examination. The experiences of North African states with terrorism are well documented in the historical archives of individual nations. Most North African states continue to fight terrorism as another human social challenge. Terrorism which is not a recent phenomenon in North Africa has in fact threatened the political, social and, economic stability and cohesion of that part of the African continent over the centuries. However, the threat today is the radicalization of Islam and its
associated consequences. This radicalization can be seen as a political ideological movement that sees Islam as a vehicle for ideological, political, economic and social dominance. The fundamentalists advocate fundamental change in their social well being, and they tend to aspire to be more radical and adopt religiously and politically radical views of issues affecting them. This radicalization has generated and triggered more deadly terrorist activities in the North African region. The question has been: Why is this happening in North Africa? Literature suggests/argues that Islamic radicalism is a political response to the deepening social challenges in the region. Others argue that radicalization possesses three faces including religious, reformist and extremist perspectives respectively. This paper will examine these issues that are fueling the terrorism challenges in the region and attempt to decipher North African reaction and counterterrorism response to terrorism.

Introduction

This research seeks to explain the role of culture and ideology in the decision to participate in terrorist activities by its perpetrators. The research will focus on explaining the nexus between culture, ideology and terrorism. Efforts will focus on using this research opportunity to gain a deeper insight into the mind of the terrorist and become familiar with how individuals make the decision to become terrorists. It is hoped this research will help us better understand and correlate the relationship between culture, ideology and terrorism.

The continuing upsurge in global terrorist activities has generated prolific literature on the subject and issues associated with terrorism. There are crucial aspects of terrorism that have not enjoyed the focused attention of the general global citizenry. Specifically, this paper focuses on the analysis of the juncture at which terrorism and African cultures and traditions known to be peaceful, graceful and non-violent collide or embrace. How can the apparent historical incompatibility between terrorism and African culture be explained? Can this amalgamated conjugation of ideas be diffused or resolved?

Definition

Terrorism is a difficult concept to define. In fact there does not seem to be a universally acceptable definition of the concept of terrorism. However, the problem of definition has not impeded research into the meaning, ramifications and wider implications of this international phenomenon. Jonathan White (2009) defines terrorism as a “tactical phenomenon that fluctuates according to geographical and cultural variables… it cannot be strictly defined because it is intangible… typologies do not account for all forms of terrorism… ideological terrorism is not the exclusive property of the revolutionary left”. Onwudiwe, (2006) argues that “the modern day
style of terrorism invites a new definition of the phenomenon… sub-national groups or clandestine agents have broadly defined terrorism as politically motivated violence perpetrated against non-combatant targets”. It is the authors’ position that “A terrorist group is defined as a group that practices, or which has significant sub-groups which practices terrorism”.

Other experts agree that the definition of terrorism must include state sponsored, transnational and national dimensions of the phenomenon referred to as the three broad faces of terrorism. The United Nations relinquished her global authority on this issue when in 1972, it failed to reach a compromise on how terrorism should be defined mainly because member states sees terrorism from individual nations’ political perspective. However, it is our position that the definition of terrorism has a common thread: Politically, economically and ideologically motivated behavior.

In 1994, Martha Crenshaw declared that terrorism in Africa developed from revolutionary pressures at home, regional battles, economic conflicts, and regime tyranny. Onwudtuwe (2006) agrees with her and states that terrorism in Africa stems from internal civil unrests and spill over from regional wars as African rebel movements and opposition groups employ terrorist tactics in pursuit of their political, social, or economic goals”. It is our position however that terrorist motivation cannot and should not be restricted to only the politics of economy, rather, it should be expanded to include religion and ideology. It is noteworthy that the earliest records of African culture and traditional civilization being mainly oral and archeological, makes accurate determination of the dates of its origin rather uncertain, even though some records can be found in national historical archives.

Background

African cultures are primarily religious in nature. It has been argued that terrorism should be seen as the dramatization of extreme violence when conventional society disagrees with a group of psychologically unbalanced fascists. It is further argued that the intention of the terrorists is to generate a psychological cloud of terror and fear for the purpose of gaining attention for their political and social goals. Newman and Lynch (1987) viewed ideology as an important component that distinguishes one terrorist group from another, and terrorists from non-terrorists. While terrorism in one form or another is centuries old, the phenomenon has in recent history developed into gradually inevitable means to attaining political, social or economic goals. It has become a strategy widely utilized by the non-privileged, the modern day proletariat, peasants or lower classes of society across the globe.

This phenomenon according to some students and or experts of the concept is archeologically traceable to at least the “Hashashin” or Brotherhood of Assassins of the radical Muslim sect of the middle ages and individual acts of terrorist activities of the ancient Greek democracies…the assassination of Julius Caesar in 41 B.C, and Roman republics…utilized by Scarii and Jewish
zealots against the Roman occupation in Palestine and the historically legendary “reign of terror” by the Jacobins and their agents and partisans in the French Revolution that occurred between 1792 and 1794.

The existence of human violence according to Ali Mazrui, (2004) can also be seen in the 19th century terrorist tactics employed by the early nationalist guerilla struggles and clandestine movements of groups like the Macedonians (Internal Macedonians Revolutionary Organization or IMRO) against Turkey, Serbs against the Austro-Hungarian empire in 1914… through the black hand and Jews in the 1940s against the British, Palestinians and other groups… the Zionists… Jewish underground forces like Stern Gang, Hganah and the Irgun Tzvai Leumi. Contemporary groups have replaced those legends of our violent history.

Today however, the groups are more violent and more deadly on large scale. These contemporary groups are much more, well financed, mobile, cellular, structurally organized, and better equipped with modern technology, science and logistical boldness.

Mazrui (2004) tells us that groups like the German Baader Meinhof Gang and the Red army Faction, the Italian Red Brigades which kidnapped and killed the Italian Prime Minister Aldo Moro in 1978, the French Action Directe, the Japanese Red Army, Belgium’s Communist Combatant Cells, and the International faction of Revolutionary Cells of the troublesome “Carlos the Jackal” are alive and potent. Today however, the most notorious are the Islamic terrorist groups which are either sponsored and/or financed by States, individuals or group of individuals today referred to as fascists, fundamentalists, extremists or Islamists.

Prominent among these groups and probably the most popular is the Palestinian Liberation Organization, a popular front for the liberation of Palestine. Others which are equally extreme in their religious fanaticism are the Sikh extremists who assassinated Indira Gandhi of India in 1984 and who later bombed a jetliner killing 329 innocent civilians in Ireland in 1985, the Justice Commandos of the Armenian genocide in Turkey, the Shia organizations sponsored by Iran such as the Hezbollah that massacred 241 U.S marines in a suicide truck bombing in Beirut, Lebanon, in 1983 and the Islamic Jihad, responsible for suicide bombings in the 1980s and 1990s and the hostage taking of US, Britain and French citizens in Lebanon.

In recent times, the world has seen a shift in the modus operandi of these groups. No longer do these groups operate in secrecy and surprises as they did in the long past. Now, the groups sometimes actually give targets warnings of the impending violence they intend to inflict. Today, it seems clear that the silent but vicious political and economic imperialistic terrorism has been replaced by fundamentalism of the extremist right and the underlying ideologies cut across different religious and racial groups. However, the most serious concern for the western hemisphere is the growing appeal of fundamentalist Islam in the Muslim world and in Africa in particular.
**Ideology**

The Oxford Dictionary defines Ideology as the body of doctrine, myth, belief, etc., that guides an individual, social movement, institution, class, or large group and such a body of doctrine, myth, belief etc., with reference to some political and social plan, as that of fascism, along with the devices for putting it into operation. It has also be seen as a complete set of ideas belonging to a coherent group, about the structure of forces in society, about the existing mechanisms of economic distribution, conflicts in society, and means to improve the present status.

Some examples of complete set of ideas like communism, liberalism, conservatism, democracy, fascism, extremism, and fundamentalism are ideologies. In terms of terrorism, Newman and lynch (1987) tells us that “Ideology is an important component that distinguishes one terrorist group from another and terrorists from non-terrorists”. Radical criminologists tend to be suspicious of the authority that has the opportunity and political and economic power to define terrorism as ideology of hate and violence. Perdue (1989) for example argued that ideology is shaped by historical events….the privileged groups in a divided world who gain more from the world perking order often view the world differently than the peasants. There are two types of ideology according to Mannheim (1968) “The Particular” which asserts that opposing groups share similar views for questioning truth and “The Total” which rejects motivation while concentrating on different intellectual universal thought systems. It is Onwudiwe’s (2001) position that “it focuses on relationships between social forces and worldviews with emphases on those that favor the status quo and those that favor change”. Mannheim (1968) like many radical criminologists conceptualized ideology as collective thought schemes held by world ruling class groups whose interest is not to disturb the status quo or the world perking order. Perdue (1989) emphasized terrorism in terms of conflict over ideas and power relations which are capable of bringing about change in society. We must be careful in relegating definition to only the politically and economically powerful since definition itself is based on the ideology of those who have the power to define who is a terrorist and what terrorism entails. Jaffe (1985), for example tells us that leaders of the Nationalists movements in Africa were mostly labeled as either communists or terrorists. Onwudiwe (2001) points out that early European so-called expert analyses of Africa were defective particularly in their treatment and definition of African Nationalism which was regarded as aggression towards the “Queen” and other European Colonial Powers. These same European experts never saw the American KKK as a terrorist group until Jonathan White (2002) who defines the KKK as the oldest terrorist group in the United States.

Ideology will be defined in this research according to White (2009), as consisting of a system of thoughts possessed by certain groups or individuals, or a set of principles espoused by political groups.
The ideological positions of the states including Iran, Iraq, Syria, Libya, Sudan, Afghanistan and other North African states that sponsor extremist Islamic groups such as Hamas, Hezbollah, Armed Islamic group, Gamaa-al- Islamiya, Islamic Jihad and Al Qaeda are clear as reflected in their vehement anti-US, anti-Western and anti-Zionists stance. In fact the United States is seen by most of these states and their followers as the “great Satan” who wants to “bestride the narrow world like a colossus” and to continue to dominate, exploit, oppress, and corrupt the world with polluted justice. The disdain of the terrorist groups across the world for the west, particularly the United States is further exacerbated by United States support of Israel, considered a Zionist state or an American outpost by most Middle Eastern countries.

There is a critical new challenge for America concerning the polarization of allied countries in Africa by fundamentalists Islamic groups. The theoretical conjugation postulated by Harvard Professor S. Huntington, regarding the inevitability of the clash of civilizations between the secular west and its Judeo Christian ideals versus Islam evidently constitutes the gathering cloud of violence and potentially deadly threats. So the scramble for Africa has begun yet again. Only this time the scramble is entrenched in ideological confrontations and only in pockets of regions because some African states have already internalized opposing ideologies to the ideology of hate, destruction and annihilation at the heart of the credo of terrorists.

The real battle grounds are in those states that are bereft of any ideologies or those which have been infiltrated by a number of obnoxious ideologies of hate and destruction. Some scholars in Africa see this invasion by foreign obnoxious ideologies as a clash or a marathon between two warring sides. This assertion is qualified on the basis of the fact that both the obnoxious invading ideologies and the healthy ideologies are welcomed for what (political and economic handouts) they are able to offer struggling states not, because of the decency and justice in the ideologies.

The question yet to be fully addressed is how vulnerable African states are, to terrorism. Karl Wycoff (2004) who was Associate Coordinator in the Office of the Coordinator for Counterterrorism, testifying before the U.S Congress’ International Committee and Subcommittee on Africa, 2004 stated that Africa is vulnerable to the threat of international terrorism and it is important that we put together our efforts to counter that menace. The state Department bases African vulnerability to terrorism on the attacks on U.S Embassies in Kenya and Tanzanian in 1998 and other attacks in Mombasa in 2002 respectively. The point that was not clearly clarified in respect of those attacks is whether or not indigenous Africans were involved, and whether they were African traditional religionists, Christians or Moslems.

While it not right to determine who is or is not a terrorist based solely on religion, plenty of evidence exists to suggest that more of the practitioners of the Muslim faith tend to engage in terrorist practices often in the name of their religion. It must be emphasized that the majority of Muslims are peaceful people who do not engage in terrorism. To buttress that point, one can easily refer to the published fact that the Nigerian Muslim father of the U.S. Christmas bomber
was the one who reported the suspicious behavior of his son to appropriate authorities in Nigeria before he embarked on his trip to the United States to carry out his aborted nefarious act.

The high positions occupied by some Al Qaeda members who are citizens of a geographically defined African country, but who are, for all intents and purposes, culturally and religiously Arab countries, is bound to create some confusion as to whether Africans can be said to be terrorists. After the death of Osama bin Laden, Saif al Adel an Egyptian was announced as his interim successor and Bin Laden’s second in command-Ayaman al Zawahiri, another Egyptian medical doctor was highly favored to become Bin Laden’s ultimate successor.

Competing Ideologies in Africa

The US State Department is very concerned about the Horn of Africa and the risks of terrorism that countries like Somalia, Ethiopia, Eritrea, Djibouti, Kenya and Tanzanian may ultimately face. In these countries, we may be engaging in an unachievable goal of protection against terrorism because of the entrenched Islamic radicalism that exists in some or most Eastern African states even though they do not belong to countries in the Arab League. The main contributing factors to African vulnerability to terrorism according to Wycoff is the continents’ close proximity to the Arabian peninsula, the failed state of Somalia, weak court and police capabilities in host nations, the continuing presence of al Qaeda cells and the long standing conflicts that have plagued the region since independence from colonial rule.

Knowing what we know and what may be happening, the obnoxious invading ideologies are in fact in for a rude awakening. Africa, though a bundle of tribes, cultural, religious and ethnic groups, the culture and tradition of the majority of the people is religiously and spiritually based. Anywhere you come from as long as you are a true African, and no matter what religion you may practice, the traditional African values come first and foremost.

African Religion, Culture and Terrorism

African traditional religions embrace the oneness of life as a whole and worshiping is a process that touches every facet of life. In African Traditional Religion, God and divinities are worshipped with sacrifices, with prayers, with incantations, invocations, praises, music and dances and in a ritualistic process of coordinated efforts of spiritual vigilance that recognizes the human failings in faith.
“The goal of interaction of beings in African world-views is the maintenance of the integration and balance of the beings in it [the world]. Harmonious interaction of beings leads to the mutual strengthening of the beings involved, and enhances the growth of life. A pernicious influence from one being weakens other beings and threatens the harmony and integration of the whole” (Emefie IKENGA-METUH, 1987).

In the meaning of peace in Africa traditional religion and culture, Godfrey Igwebuike Onah of the Pontifical Urban University, Rome declared and argued that “Competition and aggression are not quite the same, even though the former has the potential of degenerating into the latter. Competition seems to be the communitarian form of the person’s natural tendency to move beyond already realized goals. Human beings may be naturally competitive, but they are not naturally aggressive. Aggressive behaviour is often a result of the failure of reason, and extreme aggressiveness is sometimes a symptom of ill health. If today this aggressive behaviour has become so widespread and so institutionalized, the cause has to be sought not in human nature itself but in the unbridled greed of some. For, as Frank Buchman rightly said: “There is enough in the world for everyone’s need, but not enough for everyone’s greed.”

Furthermore, it is his position that “the sharing commanded by African traditional moral norms is capable of keeping competition healthy and preventing it from degenerating into aggression. Rather than force Africans to abandon their traditional moral and religious values of sharing and communion to embrace the individualistic and aggressive attitude of some other culture, the rest of the world should learn these values from the Africans and humanity in general will be enriched. Is it possible to globalize some African moral and religious values, or are we resigned to a unidirectional globalization of values and non-values”?

African Traditional Religion teaches that there is no direct contact with the Almighty God hence the need for intermediaries in the form of religious functionaries, divinities and of course the ancestors. That religion also teaches that there is no clear separation between the spiritual and the material, the sacred and the profane. Rivers, Trees, Forests, Mountains and others serve as solace and sacramental worship and holy places and are considered manifestations of the sacred. These intermediaries are good spirits and constantly implored as they are venerated to intervene on behalf of worshippers. The invading ideologies that are less radical and therefore more compatible with the deep traditions and culture of traditional Africa may be victorious and become assimilated into African culture in the new wave of scramble for Africa.
While it is practically impossible to speak of Africa as a homogeneous singular community, at the same time it cannot be written that Africa is a plethora of isolated tribal or ethnic groups. Even the diverse and widely spread social-physical environments make Africa, and though inherently fragmented, it is one whole entity of social and cultural adaptations of fundamentally entrenched traditions. Therefore a pertinent and absolutely significant aspect of African culture and religion is the principle of justice for all. In African Religion and tradition, justice is a universal language. It is a crucial aspect of African-ness, the purity of the continent and the spirit of the truth epitomized in the report of a father of a terrorist son to the authorities as stated above. African culture and tradition demands openness and welcomes all no matter who you are and where you come from. The question may be-which of the known foreign ideologies are characterized by those African virtues?

Another important factor is how the foreign ideologies define terrorism and how they analyze the causes of terrorism. This time however, the African people can see clearly what is on its way to the continent. It is pertinent here to establish that African cultures and traditions overwhelmingly value and celebrate the absence of violence, wars, consternation and devilish surprises. In most of traditional African cultures, peace and harmony mean living in accordance with the purified and cogent spiritual principles in relation with the supernatural, deities, spirits and the physical nature at large. Africa does not truly distinguish herself from objects. It strongly connects with what Africa sees as unitary conception of reality.

War and violence break the truce between nature and the physical environment that is critical to experiencing spiritual harmony. Ali A. Mazrui in his discussion of ‘Towards Understanding the causes of terrorism: the culture, the mission, the motive and the target’ emphasized the importance of culture. According to Mazrui, ‘cultures differ in how they react to a sense of injustice…some may lean towards correction and compensation or reparation and others retaliation, vengeance and war”. Cultures, Mazrui argued, also differ in levels of hate-retention across generations…Armenian socialization encourages a continuing sense of outrage even today for the massacre of Armenians by the Ottoman empire during WW1. On the other hand, South Africans plea the cause of the satanic sinners who massacred, tortured, brutalized men, women, children, land and dreams during apartheid. Even more strikingly critical are the differences between cultures that produce suicide-warriors such as the Japanese culture given vent to during WW1 and the Palestinians’ Intifadah.

The escalation of terrorism in the Middle East is instructive. In fact as terrorism escalates in the Middle East, it never really provokes the direct response of acceptance by African states As the Arabs and some of the Muslim communities across the globe cultivate hate, anger, and violence against the West, Africans are debating how to implement the “Truth and Reconciliation” policy to forgive imperialists, colonialists, murderers, treasonous, common thieves, white men and women whose crimes were mostly those of ‘Man’s Inhumanity to Man’.
Furthermore, anti-western terror philosophy seems to have been provoked and triggered by the remnants of imperialism in the Middle East left behind by European colonial rule in Egypt, in Iraq, Jordan, Sudan and several other African States and by French colonial rule in Syria, Lebanon, Algeria, Morocco, Tunisia, and other states. On the other hand imperialism incited the deadliest hatred and deadly levels of anti-western sentiments until independence. Similarly, imperialism triggered in Africa and the Middle East the most explosive anti-western anger before colonialism was defeated in both regions. However, while the middle-east had recourse to terrorist tactics to remove the remnants of imperialism, much of Africa has chosen unannounced reparations that come in the forms of aid to Africa from former colonial masters.

Africa and middle-east differ tremendously in their reaction to imperialism based on cultural differences. The post-colonial middle-east is very different from Africa probably because the Middle East region was fractionalized by outsiders/imperialists purposefully to maintain some element of power and access. Some middle-east regions in postcolonial days incurred permanent loss of territory whereas postcolonial Africa embarked on only recovery of territory and leaders in South Africa for example were applauded for gaining back land previously apportioned to settlers by the apartheid regime. While the postcolonial conditions in Africa resulted in a clearer end to colonialism the middle-east was faced by contemporary imperialism. A good example can be found in what happened when the state of Israel was created followed by the subsequent occupation by Israel of the west bank of the Jordan, Gaza, Syrmas’ Golan Heights, Jerusalem, and southern Lebanon. It would appear that the westerners in allowing the occupation set the stage for terrorism as a conventional means of war by the oppressed.

While the Europeans ensured a post occupation Africa without lingering problems of major territorial boundary disputes, the postcolonial middle-east was virtually a region of the survival of the fittest resulting in territorial annexations. Africa fell in love with America, the emerging power, for fighting against injustice especially for her role in pressuring allies into giving early independence to former African and Asian colonies. In 1956 for example, when Egypt nationalized the Suez Canal and Great Britain, France and Israel invaded that country American administration turned against her allies. It was the United States which forced Israel to withdraw from the Sinai, and forced Britain and France to give up Port Said in Egypt. In fact, the first gulf war made America even more respected in Africa. The U.S was seen again as fighting for the ‘little guy’ (Kuwait). As it is well known, Africa is a bundle of ethnic groups with varying leaders who cannot imagine the national government meddling with the decisions of the traditional leaders as Iraq tried to do in Kuwait.

An important reason for a face-off between Africa and the Middle East is the decision to make parts of African such as the Mediterranean area, North African states, and Egypt parts of the Middle East. Those parts were torn away from mother Africa without any consideration of their philosophical, psychological and strategic affinity to the geographical expression ‘the African continent ‘. While the Middle East rulers were complacent, African wisdom challenged this
intrusion by westerners who had appeased the rulers of the areas carved out to silence and submission.

One critical difference between the people of the remnant of Africa and the people in the carved out area of Africa is perhaps the martyrdom complex that has enveloped the Middle Eastern people including Arabs and Jews as shown in the Egyptian Al Qaeda elements earlier mentioned. The Jews have developed the doctrine of martyrdom from memories of the Holocaust... For example, the Israeli nuclear program is partly based on the premise of ‘a readiness to defend Israel even if it means destroying oneself and much of the region’ a philosophy tantamount to collective suicide. Arabs and much of the Muslim population are practically drowned in this martyrdom complex especially among the Shia and Sunni Muslims whose suicide bombings across the Middle-East are well documented in contemporary history archives. The Middle-Easterners are willing to use any means possible to destroy what they consider their enemy. Traditional Africans will not use a gun while it is possible to wrestle for the “bread”.

Another important difference is the differences in the retention of hate, willingness and motivation for revenge. European cultures and Middle-Eastern cultures from observations seem to harbor, propagate and cultivate archaic grudges with deadly consequences. The Catholics and Protestants of Ireland, Armenians, and Kosovo descendants all in Europe and Arabs whose perceived victimization and persecution is relatively recent and tend to have a high rate of hate retention, as shown in their history of centuries old vengeance. The Jews also have high hate retention but have substituted and converted that anger of Holocaust into producing giants of successes. The Jews are responsible for much of scientific discoveries of the last century and have always espoused peace and harmony among all humankind. The Jewish community will not and has never triggered any conflict. The Jewish Culture has consistently developed new strategies for peace and continues to develop and discover new scientific and technological ways to improve quality of life for humankind.

Unlike the Middle-Eastern culture, Black Africa has restrained herself from undergoing postcolonial violence against the West which is a clear testament of the peoples’ low tolerance for revenge and political violence. Traditional Africa was once as violent especially in political matters. Africans will fight for their rights and once an enemy confesses to wrong doing and makes amends and asks for forgiveness the trouble is usually over. For example, the British colonial authorities falsely accused and imprisoned Jomo Kenyatta but later released him from prison. He magnanimously forgave the white settlers even though his administration was actually pro-western contrary to what the colonialists thought which made them witch-hunted him. Kenyatta addressed his plight in his book ‘Suffering without Bitterness’. Ian Smith, a white settler in South Africa unleashed a civil war on the country formally known as Rhodesia and thousands of Africans were massacred. Despite his despicable behavior, he was tolerated and allowed access to political power in an African ruled Zimbabwe.
The Nigerian civil war is an instructive example of self-restraint displayed by African Black People. After the Biafra civil war, many feared reprisal of major proportion against Eastern Nigerian Ibos whose attempt to break away from the country caused the war. When the secessionists surrendered there was no revenge but the then magnanimous head of state of Nigeria General Yakubu Gowon declared ‘No victor. No vanquished”. The phenomenal self-restraint and diligence of South African leader Nelson Mandela and his ANC comrades some of whom lost 27 years of freedom under the policies of the desperate and illegal apartheid regime is worthy of note here. When leaders of ANC were released from prison many feared the worst but the great African leaders sought for reconciliation and peace and forgave those oppressors and killers who inflicted draconian rule on them under the despicable apartheid regime in South Africa.

What are the true fundamental motives of this new love for Africa by these invading ideologies? America firstly, is expanding and spreading her wings in the spirit of globalization and it appears to be stretching its powers into the role of interventionism. Africa is a critical region for the success of the war on terrorism. If Africa is on the side of counter terrorism the war can and will definitely easily be won. The United States has tremendous interest in Africa and cannot afford any lack of access to Africa’s natural resources including oil, plutonium and other solid minerals in all regions of the continent. The United States needs Africa for incredibly useful intelligence, water space, political and military support and manpower. The U.S is a democratic and capitalistic society whose approach to most issues is straight forward and business-like. This attitude is sometimes misinterpreted as being arrogant by those who may already have formed an opinion about America’s culture and tradition anyway. Africans have engaged Americans in lots of transactions and with westerners for centuries and most Africans do understand the U. S. business etiquette and the environment. Black Africans are truly not interested in any hate or vengeance as preached by certain Muslim clerics whether it is in the Middle East, Africa or America (Nation of Islam) for example.

Religions do have considerable impact on how the war on terrorism can be won in Africa. Earlier in this piece, we noted that the possibility of a healthy relationship between African Traditional Religion and less radicalized version of the Muslim religion is capable of producing good results. According to Adu Boehen, Islamic religion is more compatible with African traditional culture, traditions and religion. In support of this statement it is instructive to use Nigeria as an example where Muslims were a minority group and Islam a minority religion in the Country at certain period in the historical development of Nigeria.

Africans and particularly Nigerians traded with all foreign people including the Arabs. The people of Nigeria have a wide range of interaction with Muslims and they in turn had same type of interactions with African traditional belief systems and practices. As a result of the interaction between African traditional religion and the Muslim religion, particularly at the earlier stages of infiltration, Muslims’ response to African cultures and religion unlike Christianity was
pluralistic. At that point, the invading religion accepted certain tenets of the African religion which allowed what is regarded by African historians as syncretism. Christianity on the other hand emphasized moral purity that practitioners of the religion could not afford or maintain.

Existing fossil evidence indicates that the African culture and traditional religion, for a while, “co-habited” with Islam. The increased conversion to Islamic religion is a relatively recent phenomenon, particularly in sub-Saharan Africa. The challenge is the significant exodus of African Muslims to Islam as practiced by Prophet Mohammad and some of whom are attracted to the fundamental Arab model of Islam. Boko Haram a version of radical Arab type extremist Islam has begun to dominate politics in Northern Nigeria with violent consequences. Furthermore, the main challenge is the impact on traditional African way of life. The acceptance of Islam by some Africans was not specifically as a result of the purported purity or superiority of the religion or the message therein but rather a reaction to the perceived betrayal and deception experienced from contacts with colonialists and imperialists.

African traditional religion and culture are truly a global framework of all life situations and it usually governs all society linked to the African soil ancestrally speaking. African culture is purely religious in nature. Here there are irreconcilable differences between Islam and traditional African religion and culture. Ancestral worshipping is fundamental to African religion but completely foreign to Islam. The western culture will be and is compatible in this regard to Ancestral worship. In the United States for example, The Native Americans worshipping practices are very similar to traditional African ways. Furthermore, the European Americans also worship their ancestors through objects like confederate flags, colors and signs.

Language is another factor that can determine and will continue to impact how terrorism can be prevented in Africa. In the past, most of sub-Saharan Africa was concerned about the threat of the Arabic language. It was commonly understood that imposing language on a people was a simple way of conversion to a foreign ideology. Learning Arabic language was seen as a threat in many African communities because of the manner it was introduced; sometimes by force or threat of force. The English language, though its introduction included elements of force, it also was attractive to the learner in itself as it offered ability to communicate globally in order to be able to trade on the global scene and it was necessary for western education in British colonies.

There is another dimension to the insanity of terrorism. How for instance would the African intellectual community handle terrorism? The anxiety generated by September 11 has raised the level of academic tension that was previously absent until the major terrorist attacks in the United States on 9 11. There seems to exist in literature the notion that African intellectuals are horridly divided into three major affiliations in the treatment of the topic of terrorism. The affiliations are in relation to religion, culture and economic considerations. For an example, Adu Boahen an African historian in his West African History text (1974) argued that Islamic religion was far more compatible with African traditions and culture. Is his assertion correct?
growing Muslim population in Africa and in both North and West Africa in particular is a compelling validation of his conclusion.

Africa is home to a large number of predominantly Muslim countries. The table below shows for example seven African nations occupied by a large Muslim population except for Ghana with 16%.

<table>
<thead>
<tr>
<th>COUNTRIES</th>
<th>MUSLIM POPULATION</th>
<th>CHRISTIAN POPULATION</th>
<th>INDIGENOUS BELIEF/SYNCRETISM</th>
<th>TOTAL POPULATION IN MILLIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIGERIA</td>
<td>50%</td>
<td>40%</td>
<td>10%</td>
<td>137</td>
</tr>
<tr>
<td>GHANA</td>
<td>16%</td>
<td>63%</td>
<td>21%</td>
<td>22</td>
</tr>
<tr>
<td>MAURITANIA</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>2.91</td>
</tr>
<tr>
<td>NIGER REPUBLIC</td>
<td>80%</td>
<td>10%</td>
<td>10%</td>
<td>11.34</td>
</tr>
<tr>
<td>SENEGAL</td>
<td>94%</td>
<td>5%</td>
<td>1%</td>
<td>10</td>
</tr>
<tr>
<td>TUNISIA</td>
<td>98%</td>
<td>1%</td>
<td>1%</td>
<td>9.94</td>
</tr>
<tr>
<td>ALGERIA</td>
<td>99%</td>
<td>.5%</td>
<td>.5%</td>
<td>32.82</td>
</tr>
</tbody>
</table>

Conclusion

For centuries, African Traditional Religion in its plethora of forms was practiced by the majority of the citizens in the continent but recently, Christianity and Islam have become more prominent and dominant. West African region seems steadfast and remains the largest populations that practice African Traditional Religion and syncretism. There are differences and similarities between African Traditional Religion, Islam and Christianity. Terrorism has no place in the religious, cultural and ideological stomach or vein of the African people. The invading ideologies must understand that the collision of culture and ideology does not determine one way or the other African disdain of terrorism but a wake-up call for Africans to ready-up and reject another scramble for this great continent. There is a range of explanations for the radicalization of certain segment of the African population including poverty, population of young men who are idle and with nothing to do whether employment or education and most importantly the belief that western education is a corrupt mechanism that has dissipated the economy and natural resources of majority of the nations of the continent. Furthermore, some of the leaders (political or spiritual) are corrupt and play stooges to the invading ideologies. The non-privileged populations are sometimes left with no choice but to resort to violence and can fall to the preaching of a deranged spiritual mentor.

No matter what points of arguments are posited by the protagonists of these affiliations, cultures, ideologies, the inescapable conclusion remains that terrorism is substantively bankrupt of any ‘cause’. In most African ethnic groups, especially Black Africa, it still remains a taboo for one to take one’s life. It is seen as an evil and a curse not only on a person, but also on a family and community for a person to kill. Mass killings were unheard of. Extreme anger, greed, lack of compassion, and inability to forgive, are also alien to African tradition, culture and religion. As Geoffrey Onah has espoused, lasting peace is entrenched in African religion, culture, and tradition, and Africans reject terrorism as a means of settling issues or making political points. Since traditional Africans are not willing to die for a “no cause”, not even with the promise of two thousand virgins waiting to serve their wishes on the other side of life, suicide bombings, mass killings, cannot be used as veritable instruments of terrorism, and are not attractive ventures to them.

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ASYMPTOTIC BEHAVIOR IN STOCHASTIC FUNCTIONAL DIFFERENTIAL EQUATION OF NEUTRAL TYPE

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ABSTRACT:

1. INTRODUCTION

2. SECTIONS AND SUBSECTIONS
3. CONCLUSION
4. ACKNOWLEDGEMENT
5. REFERENCES

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