A Framework for Implementing an Education Management Information System in Tanzanian Secondary Schools to Improve Delivery of Quality Education and Students' Academic Achievement

Anold Seleman Nkata [1]*, Mussa Ally Dida [2]

[1] ICT-Instructor, Arusha Technical College, TANZANIA
[2] Lecturer, The Nelson Mandela African Institution of Science and Technology, TANZANIA
*Corresponding Author: ankata@atc.ac.tz

ARTICLE INFO	ABSTRACT
Published: 30 Mar. 2020	Globally, access to quality education is being recognized by educational scholars as a significant process of poverty eradication. In developing countries including Tanzania, access to quality education is a national goal supposed to be achieved by Tanzania Development Vision 2025. However, the practice is being hindered by the use of manual systems in administering academic activities in secondary schools. The manual systems lead to loss of data integrity, work productivity of teachers, inefficiency and ineffective collection, and dissemination of educational information required to support education policymakers in planning, monitoring, and evaluation of quality educational activities. This study used structured interviews and questionnaires to collect data from educational stakeholders of the Arusha region to investigate a cost-effective digital solution required to improve the delivery of quality education for sustainable development. After data analysis, findings revealed that Tanzanian secondary schools required to use a centralized education management information system in administering schools' academic activities. The study concluded by formulating a cost-effective digital framework that can enhance the accurate and timely collection and dissemination of quality educational information for supporting planning, monitoring, and evaluation of the academic activities. Due to the tremendous change of technology, this study recommended all schools to adapt to the use of digital tools rather than manual systems in administering schools' academic activities.

Keywords: Cost-effective digital framework, centralized Education Management Information System (EMIS), Delivery of Quality Education in Tanzanian Secondary Schools |

INTRODUCTION

In the past few years particularly from 2010, the national examination results of students in Tanzanian secondary schools have brought uncertainties among educational stakeholders (Nghambi, 2014; Todd & Attfield, 2017). Most candidates who seat for national examination end up getting a marginal pass of division four and zero (MoEVT, 2014). The situation perceived by education scholars differently.

Some of them said, the high number of students in schools compared to the available learning resources is the one which leads to the poor performance of students' (Kitila, 2013). While other educational scholars said, the lack of application of digital technology in teaching and learning results in poor students' academic achievement (Ngeze, 2017). Only a few of them said poor parental involvement in monitoring and tracking students' academic progress leads to poor attendance of students at schools, and ineffective administration of schools' academic activities is one of the factors that lead to the poor performance of students in national examination results (Joseph, 2016; Limbe, 2017)

According to the education system of Tanzania, students with a marginal pass of division four and zero do not qualify to join for further studies (URT, 2015, 2018). This situation leads to the production of the high number of unskilled personnel and it affects the plan and goal of global sustainable development (UNDP, 2016). The government through the Ministry of Education, Science, and Technology (MoEST) taken various measures such as Tanzania's Transformation Journey for Big Results Now (TZDPG, 2014) and Tanzania's (2015-2018) program for the result (P4R) (Arnott, 2016) to address challenges of poor delivery of quality education which results to poor students' academic achievement. However, it remained unclear that, how can these measures enhance the delivery of quality education for sustainable development by improving the work productivity of teachers through the use of digital technology.

This study bridged this critical gap by formulating a cost-effective framework of using a centralized Education Management Information System (EMIS) in administering school academic activities to enhance effect collection and dissemination of quality data required to support the formulation of education sound polices of delivering quality of education for sustainable development. The EMIS can significantly improve the work productivity of teachers and reduce the costs associated with the use of the manual system of administering school academic activities.

Furthermore, the EMIS can be used by schools to involve parents with school academic activities, in monitoring and tracking students' academic progress using E-mail and Shirt Message Services. Parental involvement in monitoring and tracking students' academic progress can significantly improve the attendance of students' at school and it can result in the high performance of students (Harris and Goodall, 2017). The system will enable school education officers such as Ward Educational Officers (WEO) and District Education Officers (DEO) to have accurate and timely quality data for planning and relocation of education resources in secondary schools.

RELATED WORKS

Global Application of Digital Technology in Schools for the Delivery Quality of Education

The change in technology has positively impacted the way schools operate and administer school academic activities (Lewin, 2018). Social networks such as Face book, Mobile application and Twitter have been a fundamental tool for enhancing communication between teachers and parents for monitoring and tracking students' academic progress (Becta, 2015; Hogenhout, 2017). The application of web-based educational systems such as learning management information systems (LMS) and student management systems has dramatically improved teaching, learning and practices of administering the school's academic activities (Gabrielle, 2006; Olmstead, 2013). Most developed countries have positively benefited with the use of technology to deliver the quality of education for sustainable development (Luena, 2015; Saxena, 2017).

Application of Digital Technology in Administering Academic Activities in Developing Countries

Most institutions in developing countries including Tanzania, still strive to adapt to the policies and regulations of the use of digital technology (David *et al.*, 2012). Application of digital technology for teaching, learning and administering academic activities in Tanzanian secondary schools is not utilized effectively due to poor ICT infrastructure (URT, 2015). Budget constraint and lack of a cost-effective framework of implementing digital educational technology lead schools to remain on the use of the manual systems for administering academic activities (URT, 2018).

The First Plan of Implementing an Education Management Information System in Tanzanian

The plan for implementing an Education Management Information System in Tanzania started for the first time in 2004 (URT, 2010). The Ministry of Education and Culture aimed to facilitate practices of administering education activities and to support the collection and dissemination of quality data for planning, monitoring, evaluation and decision making (MoEST, 2007). Due to the scope of the project, the education management information system did not include academic activities performed at secondary school levels. Since then, most secondary schools still rely on the use of a manual system for administering the school's academic activities (Sedoyeka & Gafufen, 2016).

Access to Quality Education in Tanzanian Secondary Schools

Secondary education development program II (SEDP II) officially introduced ICT to be a pedagogical tool for teaching and learning in secondary schools to improve the practice of delivering quality education for sustainable development. However, the project did not succeed due to insufficient ICT infrastructure in secondary schools (Swarts & Wachira, 2010). Moreover, failure of using ICT content management system for teaching and learning affect the work productivity of teachers and delivery of quality of education for students' academic achievement (Crallet, 2016).

Parental Involvement for Students' Academic Achievement

The involvement of parents in monitoring and tracking students' academic progress positively contributes to the students' academic achievement (Brown, 2016; Francis, 2018). In Tanzania, most schools use letters to notify parents about the academic progress of the students (Kayombo, 2017). The methods used by schools do not effectively enhance parental involvement simply because some parents fail to involve with schools' academic activities and in monitoring and tracking students' academic progress due to social and economic activities, (Masabo, 2017).

MATERIALS AND METHODS

Study Area

The study was conducted in the Arusha region, a northern of Tanzania from June, 14th 2019 to December, 20th 2019. The region consists of seven councils which are Arusha municipal council, Arusha district council, Meru district council, Ngorongoro district council, Karatu district council, Monduli district council, and Longido district council both with an infinite population of education stakeholders. **Figure 1** is a Tanzanian map showing the Arusha region with an extension of its seven districts.
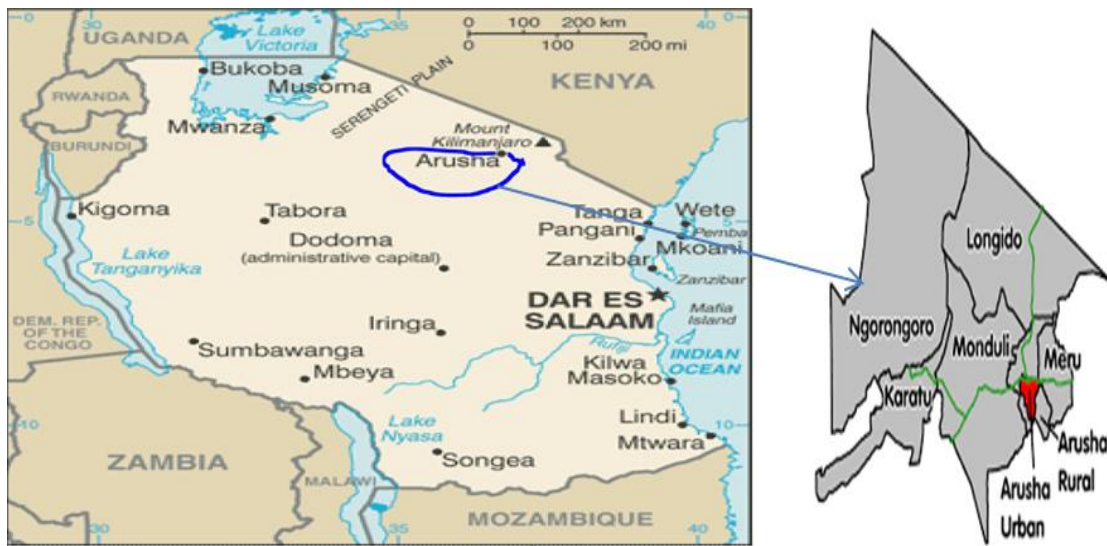
Figure 1. A map of Tanzania Contain Arusha Region and its Districts (The World Factbook)

Table 1. Number of respondents used to form a sample size

S/N	Number of Respondents	Total
1	Teachers	103
2	Students	66
3	Parents and guardians	25
4	Education officers	2
	Total	**196**

Demographic Characteristic of the Population

This study obtained an infinity population of the study from a group of students, teachers, parents and education officers of secondary schools. The population of teachers included the head of schools, school academic teachers, school discipline teachers, and other subject teachers. While the population of education officers included District Education Officers (DEO) and Ward education Officers (WEO) of the Arusha region. Parents who have students' in secondary schools were also included in the population for the study.

Sampling Methods and Sample Size

The study used simple random sampling techniques to obtain representatives of the study from the population of students, teachers, parents and education officers of the Arusha region. All students, teachers, parents and education officers of secondary schools were having an equal chance of being selected for the study. To ensure the validity and reliability of data, the study used a Cochran formula $n = \frac{z^2}{me^2} p(1-p)$ (Garcia & Gaurav, 2015) to obtain a sample size of one hundred ninety-six representatives from an infinity population for data collection. Whereby n represents sample size, Z represents Z-score. This study used a Z-score of 1.96 for the confidence level of 95%, ME represents margin error, also the study used margin error 70%, p and represents a population proportion of 50%. Then after computation, the sample size became one hundred ninety-six respondents.

$$n = \frac{1.96^2}{(0.07)^2}(0.5(0.5)) = 196$$

This sample size was formed from an infinite population of teachers, students, parents and education officers of the Arusha region who had an equal chance of being selected for the study. **Table 1** shows the number of respondents used to form a sample size of one hundred and eight respondents for data collection.

Data Collection Methods

To speed up the process of collecting data and to effectively collect a large amount of data, the study used questionnaires data collection to collect primary data from an infinity population of secondary schools educational stakeholders of secondary schools. To ensure that every interviewee is asked the same type of questions, the study used structured interviews to collect data from teachers of secondary schools, Ward Education Officer (WEO) and District Education Officer (WEO). The objective of collecting this kind of data was to identify and analyze the strength and weaknesses of an existing system that is used by secondary schools for administering academic activities. The collected data was analyzed using Pandas Python data analysis software and the results were revealed to reflect the drawbacks of the use of the manual system for administering schools' academic activities.
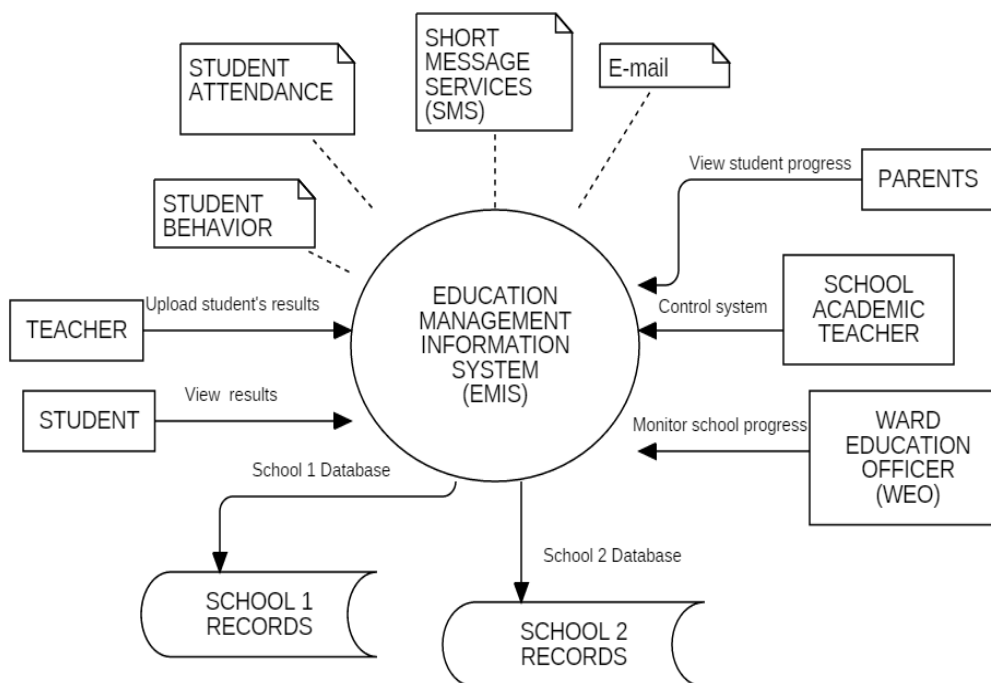
Figure 2. Context level 1 Data Flow Diagram of the Education Management Information System

Requirements Gathering

Requirement gathering is an activity of conducting system re-engineering to collect requirements of the proposed system (Sommerville, 2011). This study adopted six phases of the software development life cycle (SDLC) to gatherer functional and non-functional requirements of the cost-effective framework of implementing a digital centralized education management information system (EMIS) for administering academic activities in Tanzanian secondary schools. The six phases of SDLC used by this study were requirements gathering, requirement analysis, system implementation, system testing, operation, and maintenance.

System Analysis and Modeling

System modeling is the graphical representation of an information system (Georgiev, 2014).To make the functionality of the system to be more clear and understandable to the users of the system, the study used Unified Modeling Language (UML) notation to present an abstract of the system to the teachers of Arusha secondary schools. In software engineering Unified Modeling Language is a visual representation of the system architectures (Stevens, 2006). The study created a blueprint of the system by transforming system requirements into the context-level data flow diagram. **Figure 2** illustrates the context level 1 data flow diagram (DFD) of the Education Management Information System. The system consists of entities, system processes and other UML notations such as data storage which describes the functionality of th system for recording student behavior, class attendance, and for communiting between teachers and parents using E-mail and SMS.

RESULTS AND DISCUSSION

This study investigated the strength and weaknesses of the manual system used by Tanzanian secondary schools in administering academic activities. The study distributed questionnaires containing open-ended and closed-ended questions to collect data from one hundred and three teachers of secondary schools of the Arusha region to determine whether the manual system enhances work productivity of teachers, accurate and timely collection and dissemination of education for supporting delivery of quality education for sustainable development. After the data collection and analysis, 92.30 % of total respondents agreed that the manual system does enhance the delivery of quality education for sustainable development but it leads to a loss of work productivity teachers. While 6.20 % of total responded disagree and 1.50% said they are not aware whether the manual system lowers the work productivity of teachers and whether it does not enhance the delivery of quality education. **Figure 3** shows the results of the investigation of the strength and weaknesses of the manual system towards the delivery of quality education for students' academic achievement and sustainable development.

Also, this study evaluated available ICT infrastructures in secondary schools to determine whether it is capable of supporting the implementation of the Education Management Information system (EMIS) for administering the school's academic activities. In this respect, the study used a structured interview data collection method to collect data from teachers to determine whether their schools have powerful computer laboratories and other computers for academic use. After data collection and analysis, 88.40 % of the total respondents said their secondary schools have a powerful computer laboratory and other computers in offices for
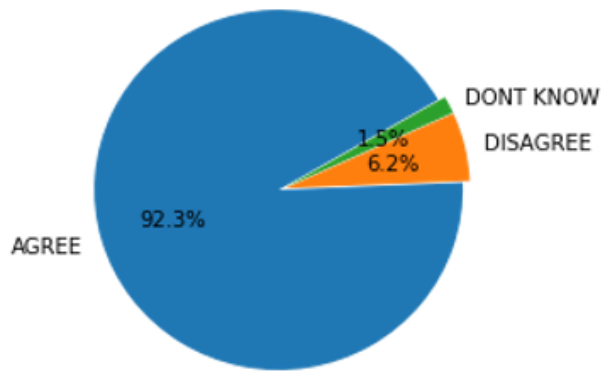
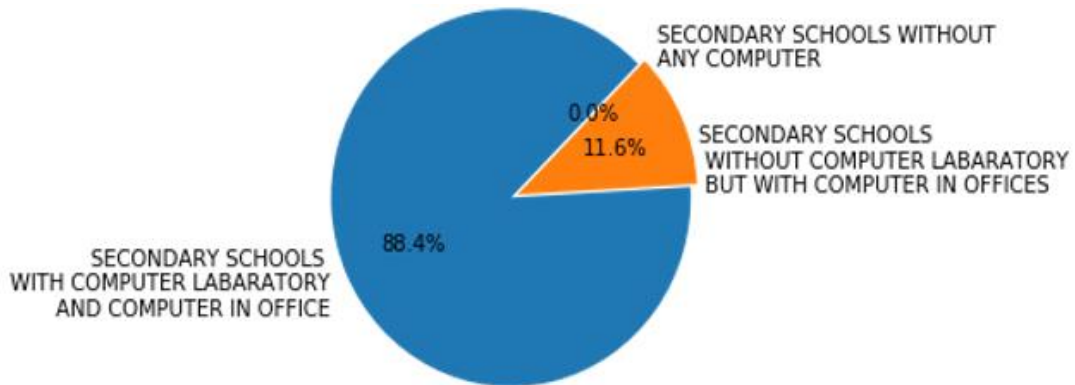**Figure 3.** Drawbacks of the Manual System of Administering Academic Activities

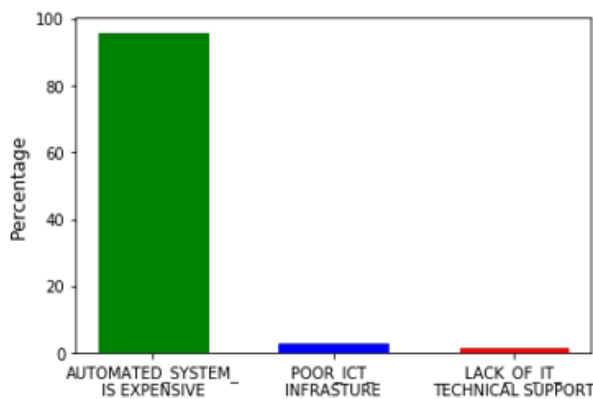**Figure 4.** Analysis of ICT Infrastructure in Secondary Schools

Figure 5. Reason on Why Schools Prefer to Use the Manual System

academic use. While 11.60 % of the total respondents said their secondary schools do not have a powerful computer laboratory, but their schools have computers for official and academic and office usage. None of the secondary schools did found with any computer at all. **Figure 4** illustrates the findings obtained after data analysis.

Furthermore, the study investigated why most secondary schools rely on the use of manual systems for administering schools' academic activities despite the available modern educational digital technology that enhances the practice of delivering quality education for students' academic achievement. In this respect, teachers from different secondary schools of Arusha have distributed questionnaire containing open-ended questions required them to provide a descriptive explanation on why Tanzanian secondary schools do not adapt to the use of modern educational management information system despite the tremendous change of technology.

After data collection and analysis, 95.60 % of the total respondents said the schools fail to afford the total cost of ownership of implementing and make of use modern educational management information systems in administering academic activities. While 3.10% of the total respondents said that, most secondary schools do not have a powerful ICT infrastructure for supporting the implementation of the modern educational management information system in administering academic activities. At the same time, 1.30% of the total respondents said most schools meet with IT technical support challenges from vendors when a system gets faults and this the reasons which made them remain on the use of the manual systems for administering academic activities. **Figure 5** shows results obtained from teachers of secondary schools of the Arusha region.
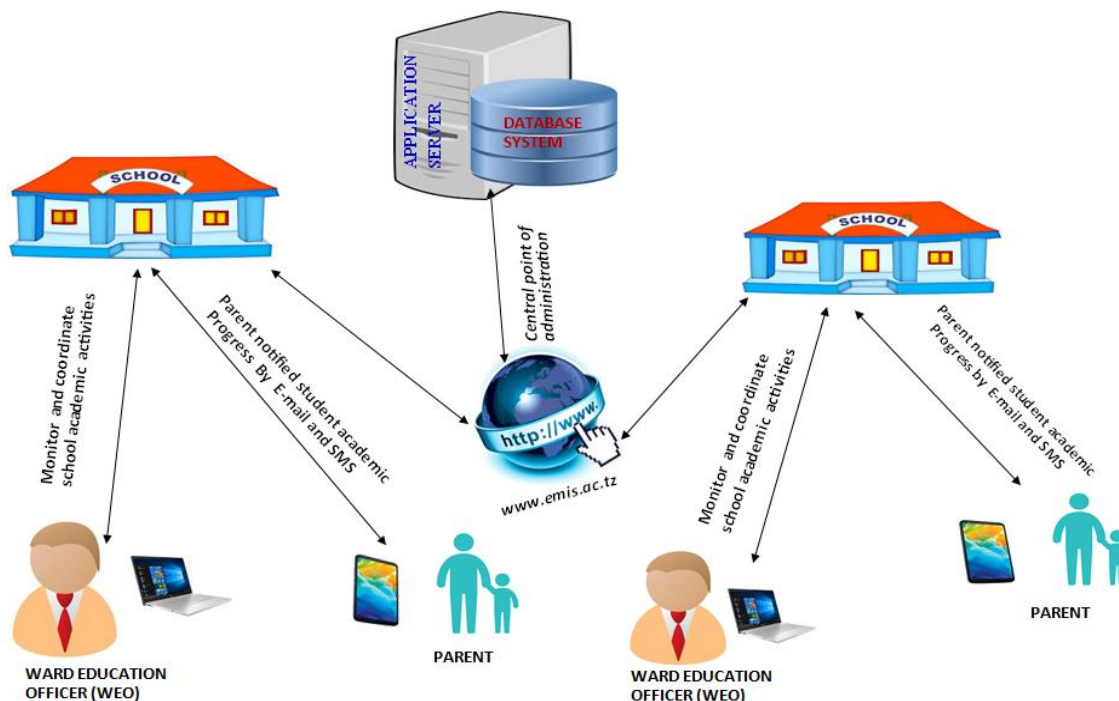
Figure 6. Proposed Framework of the Education Management Information System

The Proposed Framework of Implementing an Education Management Information System in Secondary Schools

Due to the various findings as revealed above, this study proposed the implementation of the centralized Education Management Information System (EMIS) in Tanzanian secondary school for administering schools' academic activities. The study adapted Software as a Service (SaaS) platform infrastructure to effectively reduce the costs of implementing EMIS in Tanzanian secondary schools. The system architecture is a cost-effective solution for secondary schools simply because it does not require schools to own a powerful server machine, public IP address and to the employment of IT professional system administrators for managing the system.

However, schools are required to own a powerful client machine with an internet connection. The payment model of the systems services will be based on subscription costs where schools will be provided with the domain name for name resolution while technical support will be provided by the system administrator from the root domain installed and managed at a central point of administration by the system service provider.

The school academic teacher has to play the roles of system administrators in controlling and managing the system. To enhance communication between teachers and parents in monitoring students' academic progress, all parents will be connected to the school virtually with the centralized education management information system and they will be notified of student's academic progress through E-mail and SMS. Furthermore, parents can log in to the system to monitor and track school events and students' score marks for each subject. Also, the Ward education Officers (WEO) can log in to the system instead of going to each school to track and monitor schools' academic activities and students' academic performance of examination results. **Figure 6** shows the proposed framework of the centralized education management information system which is affordable for Tanzanian secondary schools for administering schools academic activities.

Significant Contributions to the Proposed Framework

Due to budget constraints of Tanzanian secondary schools, the centralized education management information (EMIS) is expected to reduce costs of administering school academic activities, enhance the accurate and timely collection and dissemination of education information required to support planning, monitoring, and evaluation of education activities required to deliver quality education for sustainable development.

The centralized EMIS is expected to enhance parental involvement in monitoring and tracking students' academic progress and to improve students' academic achievement. Furthermore, the proposed framework provides financial benefits for secondary schools simply because it does not require secondary schools to own powerful server machines, to have an employed professional IT administrator for managing the system, and it enables schools to make payment of the systems services based on subscription.

Validation of the Proposed Framework of Administering Academic Activities

The study used questionnaires to validate user acceptance of the proposed cost-effective framework for administering school academic activities in Tanzanian secondary schools. In this respect, teachers, parents, and education officers were presented with open-ended questions and closed-ended questions to provide their views to determine whether the centralized education management information system for administering academic activities effectively enhance accurate and timely collection and
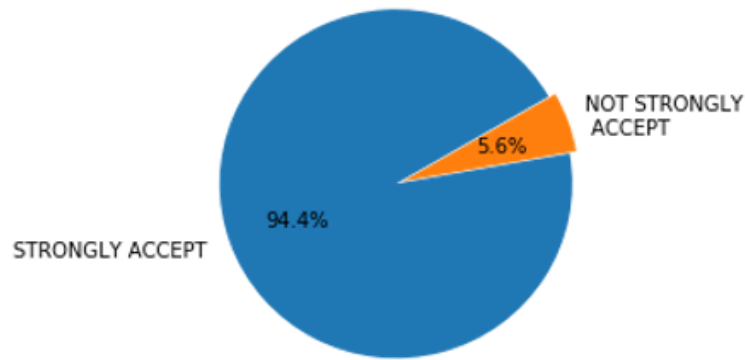
Figure 7. Results after System Validation

dissemination of quality data required to support planning, monitoring, and evaluation of delivery of quality education for students' academic achievement and sustainable development.

After data analysis, 94.40% of the total respondents acknowledged the proposed framework by agreeing that the system can enhance the efficient and effective collection and dissemination of accurate and timely educational information. Once implemented in secondary schools it is going to reduce paperwork in offices and other costs of running schools' academic activities by facilitating planning, monitoring, and relocation of education resources. The respondents went furthermore to say that most schools can afford to implement and it is going to enhance the delivery of quality education by improving communication between teachers and parents for students' academic achievement. **Figure 7** shows the results of the system validation.

CONCLUSION AND RECOMMENDATIONS

Based on the limitation of the manual system revealed by this study such as ineffective collection and dissemination of education information required to support education officers and policymakers in planning, monitoring, evaluation and relocation of education resources in Tanzanian secondary schools. The study acknowledges that the manual system used by Tanzanian secondary schools for administering school's academic activities does not support the practice of formulating educational sound policies required to improve the practice of delivering quality education for sustainable development and to improve students' academic achievement in the national examination.

Furthermore, as the manual system causes the loss of data integrity in reporting students' progress, ineffective parental involvement in monitoring and tracking students' academic progress and high costs of running schools academic activities due to the use of paper works, this study recommends all Tanzanian secondary schools to adapt to the use of a centralized education management information system for administering school academic activities rather than manual system to improve the practice of delivering quality education and to improve students' academic achievement. It is centrally hosted, cost-effective for schools belongs to developing countries like Tanzania since it does not require schools to own powerful server and public IP addresses. Instead, the system uses Software as a Service (SaaS) model whereby each school has to pay the services on a subscription basis. Due to the tremendous change of technology, this study also recommends future studies for investigating the feasibility of integrating learning management information (LMS) into a centralized education management information system (EMIS) to improve the productivity of teachers and students in teaching and learning practices.

REFERENCES

Becta (2015) *Exploiting ICT to improve parental engagement, moving towards online reporting (British Educational Communications and Technology Agency Report)*. Retrieved from http://www.becta.org.uk

Brown, P. (2016). Involving Parents in the Education of Their Children. *Ossc Bulletin*, pp. 1-5.

Crallet, V. (2016). Support of ICT use in Tanzania Secondary Schools: The Case of Dodoma Municipality, 134(16), 12-16. https://doi.org/10.5120/ijca2016908171

David, *et al.* (2012). Exploring the use of new technologies in education. *EduTech*, 1-28.

Francis, T. (2018). *Parents, their Children and schools*. Edited by B. Schneider and J. S. Coleman. New York: Routledge.

Gabrielle, A. (2006). Using Data to Support Learning in Schools: Students, teachers, systems. *Australian education review*.

Garcia, C., & Gaurav, J. (2015). *The ultimate guide to effective Data Collection*. Edited by W. E. Deming. Socialcops. Retrieved from http://socialcops.com/ebooks/data-collection/

Georgiev, V. (2014). Software Development Methodologies for Reducing Project Risks, (2).

Harris, A., & Goodall, J. (2017). Engaging Parents in Raising Achievement- Do They Know They Matter? *University of Warwick*, (July), pp. 1-93. https://doi.org/10.1080/00131880802309424

Hogenhout, A. M. (2017). Parental Involvement in Indian Education, (201600407).

Joseph, C. (2016). *Factors hindering Parents' Participation in School Activities in Tanzania* (Unpublished Thesis). The Open University of Tanzania. Retrieved from http://repository.out.ac.tz/587/1/DSERTATION_-_CARLOS.pdf

Kayombo, C. (2017). *The role of parents involvement towards students academic performance among public school in Tanzania*.

Kitila, M. (2013) *Does School Environment Affect Students' Achievement? A Investigation into the Relationship Between Secondary Schools Characteristics and Academic Performance in Tanzania.* Retrieved from http://hakielimu.org/files/publications/Does SchoolEnvironmentAffectStudentAchievement.pdf

Lewin (2018). Computers & Education Technology to support parental engagement in elementary education: Lessons learned from the UK. *Journal of Computers & Education*, *54*(3), 749-758. https://doi.org/10.1016/j.compedu.2009.08.010

Limbe, B. D. (2017). *Factors affecting student performance in secondary school examination* (Unpublished Master' Thesis). The Open Univeristy of Tanzania. Retrieved from http://repository.out.ac.tz/1748/1/LIMBE-DISSERTATION_-18-01-2017

Luena, A. M. (2015). *Strengthening the Education Management Information System (EMIS)*. Retrieved from https://scholarworks.umass.edu/cie_capstones/21

Masabo, S. L. P. (2017). Parental Involvement in School Activities in Kibondo District, Tanzania: Challenges and Remedies. *International Journal of Education and Research*, *5*(10), 89-96.

MoEVT (2014). *Proposed secondary education developement program II (SEDP II) 2010 - 2014*. Retrieved from http://www.unesco.org/education/edurights/media/docs/3e1b3c4a9ac660e5c3528470d366bc316b1591c9.pdf

Ngeze, L. V (2017). ICT Integration in Teaching and Learning in Secondary Schools in Tanzania: Readiness and Way Forward. *International Journal of Information and Education Technology, 7*(6). https://doi.org/10.18178/ijiet.2017.7.6.905

Nghambi (2014). *Factors Contributing to Poor Academic Performance in Certificate of Secondary Education Examination for Community Secondary Schools in Urambo District, Tabora, Tanzania* (Unpublished Thesis). The Open University of Tanzania.

Olmstead (2013). Using technology to increase parental involvement in schools. *TechTrends, 57*(6). https://doi.org/10.1007/s11528-013-0699-0

Saxena, N. (2017). The role and impact of ICT in improving the quality of education. http://doi.org/10.5281/zenodo.439205

Sedoyeka, E., & Gafufen, G. (2016). Computers in Tanzania Secondary Schools - Challenges and Opportunities. *International Journal of Computing and ICT Research, 7*(1), 22-32.

Sommerville, I. (2011). *Software Engineering*. 9th editio. Edited by M. Hirsch. Addison-Wesley.

Stevens, P. (2006) *Using UML Software Engineering with Objects and Components*. 2nd Edition. British Library Cataloguing-in-Publication Data. Retrieved from www.pearson.co.uk

Swarts, P., & Wachira, M. E. (2010). Tanzania: ICT in education situational analysis. *Global e-Schools and Communities Initiative*, (July), 1-67.

Todd, R., & Attfield, I. (2017). Big Results Now! in Tanzanian education: Has the Delivery Approach delivered? (March).

UNDP (2016). *Global Sustainable Development Report: 2016 Edition*. Retrieved from https://sustainabledevelopment.un.org/content/documents/2328GlobalSustainabledevelopmentreport2016(final).pdf

URT (2010). The United Republic of Tanzania.Ministry of Finance and Planning Tanzania Development Plan, Vision and Priorities to Achieve Middle Income Status by 2025 Contents from Ministry of Finance & Planning and distribute, pp. 1-35. Retrieved from https://www.mcci.org/media/154357/tanzania-developemnt-plan-booklet.pdf

URT (2015). *Secondary Education Development Programme II (July 2010-June 2015), Final Draft*. Retrieved from https://planipolis.iiep.unesco.org/sites/planipolis/files/ressources/tanzania_sedp_2010_2015.pdf

URT (2018). *Education Sector Development Plan:, Ministry of Education, Science and Technology*. Retrieved from https://www.globalpartnership.org/sites/default/files/2019-04-gpe-tanzania-esp.pdf