IOSR Journal of Mathematics (IOSR-JM)
e-ISSN: 2278-5728, p-ISSN: 2319-765X. Volume 11, Issue 5 Ver. I (Sep. - Oct. 2015), PP 20-23
www.iosrjournals.org

Pedagogical Practicesin Integrationof ICT in Teaching and Learning Mathematics, in Secondary Schools in Nairobi County, Kenya.

Sheila Amuko
School of Education Kenyatta University P.O .Box 43844-00100 Nairobi ,Kenya.

Abstract: *This presentation is based on a large study whose purpose was to explore the pedagogical practices in integration of ICT in teaching and learning mathematics in secondary schools in Nairobi County. The study adopted a descriptive survey design. Three instruments questionnaires', a structured interview schedule and an observation checklist were used to collect data. The study was carried out in twelve public secondary schools in Nairobi County. Data was analysed using descriptive statistics. Findings from the study indicated that, there were low levels of ICT integration, Mathematics teachers were not well prepared to integrate ICT in teaching Mathematics. Findings from the study indicated that, teachers face major challenges such as the expectation to, develop their technological skills and knowledge as well as use ICTs in their teaching, without support leading to low levels of ICT integration in teaching and learning Mathematics. And this is the main limitation in integrating technology in their teaching inspite of the enthusiasm. This study recommends that teachers be supported to integrate technology in teaching mathematics and to increase access to technology opportunities to learn. To increase use of technology the study recommends intensive training of use of technology during pre-service course besides the in-service.*

Keywords: *ICT, Mathematics, Pedagogical practices, teaching mathematics and learning mathematics.*

I. Introduction

The most prominent, recent and modern tool for teaching is Information Communication and Technology (ICT) (Laborde and Strä\s ser, 2010).There are several benefits of using ICT in teaching and learning Mathematics.ICT has the potential to transform the nature of education; improving teacher's design work, enhancing the roles of students and teachers in the learning process and helping to create a collaborative learning environment (Khan, Hossain, Hasan and Clement, 2012). As a result, the integrating of ICT in teaching and learning is high on the educational reform agenda of developed and developing countries. For developing countries, ICT can be seen as a way to merge and even leapfrog into a globalizing, technological world. In spite of the use of ICT for teaching is limited at best (Peeraer and Van Petegem, 2011).

Pedagogical Practices in Integration of ICT in Teaching and Learning Mathematics

Pedagogyis focused on teachers' instructional practices and knowledge of the curriculum and the development of applications within their disciplines that make effective use of ICTs to support and extend teaching and learning (Girgin, Kurt and Odabasi, 2011). Pedagogical content knowledge refers to planning and implementing instruction of authentic Mathematics tasks to foster students' learning process. Planning requires teachers' high order thinking skills and creation of new Self-Regulated Learning (SRL)-stimulating components in pedagogical contexts (Zohar and Schwartzer, 2005). Syfers (2010)proposed three types of Mathematicscurricular system models: content focused, pedagogically focused, and learner-centred. He further maintains that the curriculum model comprises different pedagogical strategies, inter alia collaborative learning, problem-based learning and direct representation, in which ICT can act as a learning tool. In addition Hoyles and Lagrange (2009) argued that a wide variety of technologies can mediate interaction, but it is how these technologies are used to support collaborative practices that make the difference in teaching and learning. The use of technologies to support collaborative learning practices requires new ways of learning and teaching and a new mind set about what it is to do Mathematics.

Dionys (2012), in outlining his ideas about TPACK, concludes by highlighting the challenges of teachers' attitude change towards instructional approaches. Parkay, Stanford and Gougeon (2010) incorporate inquiry based learning in teacher education courses, strengthening the pedagogical foundation for technology integration. Lim and Pannen (2012) linked ICT competence and pedagogical consideration when evaluating teacher education programs. However, deeply rooted beliefs can prove to be hard to detect and unless deep changes are effected, the programs may teach skills and knowledge but still fail to produce the necessary shift in pedagogy (Lim and Chai 2008) . Using technology effectively requires teachers to have a wide repertoire of teaching approaches to call upon. Teachers must be proficient in using ICT not only to support their

professional productivity and development, but mainly, to effectively integrate ICT into instruction and learning**.** Effective teacher preparation is an important factor for successful integration and sustainability of ICT in education(Jimoyiannis, Tsiotakis, Roussinos and Siorenta, 2013).

Technology proficiency is not a strong predictor of technology integration and those successful educational applications of ICT depend upon proficiency in the instructional methods (Girgin, Kurt and Odabasi, 2011). Most ICT teacher professional development initiatives tend to focus on technological aspects (i.e., how to use various tools) while pedagogical and instructional issues (i.e., why and how to use those tools to enhance learning) are often taken for granted. As a consequence, the application of ICT in school settings has been driven more by the accordance of technology rather than by the demands of pedagogy and didactics of the particular subject matter (Jimoyiannis et al., 2013). Training and the typical content of technology instruction for teachers are also reported as limited to computer literacy, with a focus on fundamental computer operation and standard applications rather than preparation on how to use technology as a pedagogical tool (Scheg, 2014) .

Teachers in developing countries such as Kenya do not have much opportunity for professional development after initial teacher preparation (Otienoh, 2010). This is because of lack of national policy for teacher training in the pedagogical integration of ICT and the lack of theory and conceptual frameworks to inform and guide research actions in the area of teaching with technology (Miles and Singal, 2010). ICT integration in education in Kenya appears to indicate limited knowledge on the quantity and quality of research in the area of pedagogical integration of ICT (Gikonyo, 2012). However, Lee and Tsai, 2010; and Mishra and Koehler, 2006) observed that research efforts have been devoted to exploring teachers' Technological Pedagogical Content Knowledge (TPACK)..

Boaler (2013) found that the most frequently adopted activities by Mathematics teachers in her research study were 'exercise to practise skills or procedures', 'teacher lectures' and 'discovering Mathematics concepts and principles'. He further reports that teachers reported to value a more traditionally oriented curriculum, as compared to curriculum goals that focused on lifelong learning and connectedness. There is a need for clear education policy regarding teachers' professional development courses and seminars that are focused on pedagogical practices on ICT.

Pedagogical Practices in Teaching and Learning Mathematics.

Training enables teachers to acquire knowledge and skills in ICT use and integration.This was of central importance to his study as it identified pedagogical practices in teaching and learning Mathematics from the respondents, as shown on Table 1.1.

Table 1.1: Pedagogical practices in Teaching and Learning Mathematics

	Responses %			
Pedagogical Practices in Teaching and Learning Mathematics	**S/A**	**A**	**D**	**S/A**
Mathematics teachers can choose technologies that enhance what they teach, how they teach and what students learn.	64	36	-	-
I can provide leadership in helping others to coordinate the use of Mathematics content, technologies, and teaching approaches at my school.	64	36	-	-
Schools should set up incentives programs to encourage and facilitate the pedagogical integration of ICT.	73	09	18	-
There is inadequate Mathematics pedagogical focus in ICT preparation programs.	27	37	18	18
Mathematics teachers lack pedagogical and content knowledge about ways to integrate ICT in Mathematics lessons.	09	55	18	18

According to Table 1.1, 64% of the respondents strongly agreed that, Mathematics teachers can choose technologies that enhance what they teach, how they teach and what students learn. In addition 64% of the respondents strongly agreed that they could provide leadership in helping others to coordinate the use of Mathematics content, technologies, and teaching approaches in their schools. That schools should come up with ways to encourage and facilitate the pedagogical integration of ICT was strongly agreed by three quarters of the respondents.Thirty six per cent (36%) of the respondents agreed that there was inadequate Mathematics pedagogical focus in ICT preparation programs, while 54 % of the respondents agreed that Mathematics teachers lacked pedagogical and content knowledge about ways to integrate ICT in Mathematics lessons. This reveals that there were a variety of ICT infrastructure that were available for use and teachers were willing to use but due to lack of proper training on their use, they were unable to use them effectively. Using technology effectively requires teachers to have a wide repertoire of teaching approaches to call upon. Teachers must be

proficient in using ICT not only to support their professional productivity and development, but mainly, to effectively integrate ICT into instruction and learning**.** Effective teacher preparation is an important factor for successful integration and sustainability of ICT in education(Jimoyiannis et al., 2013).

Time for Learning Mathematical and the Computer Technology

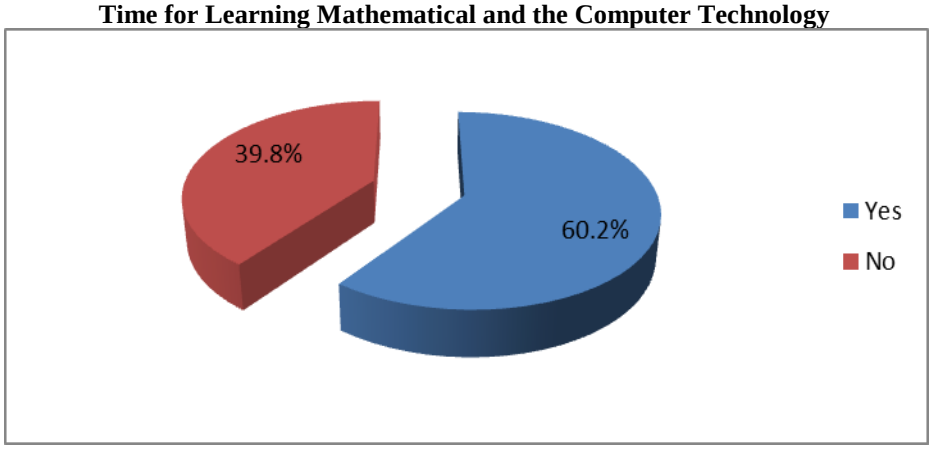

Figure 1.1: Time for Learning Mathematics and the Computer Technology

With regard to whether there was adequate time for learning both technology and Mathematics content, majority 60.2% of the students agreed with reasons given including there being enough time to use ICT when learning Mathematics i.e during their free study time they could use computers to explore more ideas on how to perform Mathematics task. Thirty nine per cent (39%) said , there was not adequate time because they could not multi task at the same time, they were not used to explanation done by the computers using projectors, the explanation done using the projectors took them a lot of time to internalize, and they were used to chalk and board.

Opportunities of Learning Mathematics with ICT

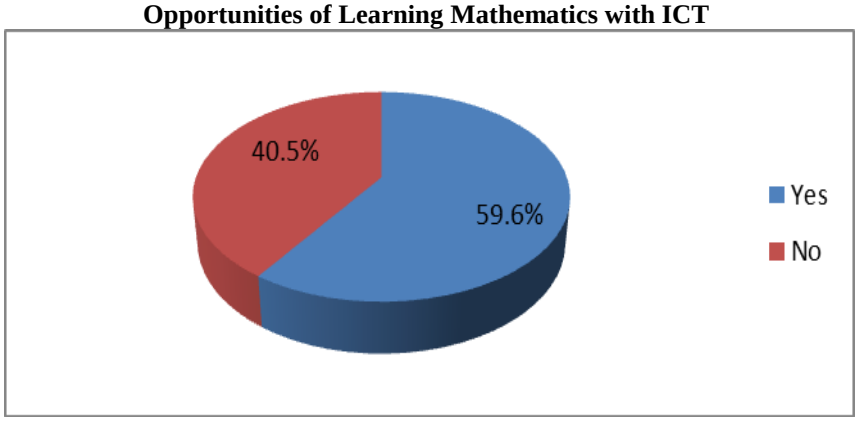

Figure 1.2 Opportunities of Learning Mathematics with ICT

In co-operate learning, the role of the teacher is to support students in every aspect of their learning. Figure 4.11 shows that 59.5% of the students indicated that there were opportunities to co-operate with other learners during Mathematics lessons with assistance of ICT, reasons including that they were able to understand Mathematics concepts well and, exchange ideas and also that there were individual benefits such as high concentration span during Mathematics discussions. Forty point five per cent 40.5% of the students said no, there was no opportunity to cooperate with other learners giving reasons including that some learners have difficulties in operating some of the ICT infrastructure, while others lacked knowledge on how to use the internet.

II. Conclusions

Pedagogical practices seem to be a challenge to teaching and learning of Mathematics in secondary schools and impacts on traditional classroom practices. Most ICT teacher professional development initiatives tend to focus on technological aspects instead of pedagogical and instructional issues. In addition, application of ICT in school settings has been driven more by the accordance of technology rather than by the demands of pedagogy and didactics of the particular subject matter.

Reference

[1]. Boaler, J. (2013). Experiencing School Mathematics: Traditional and Reform Approaches to Teaching and their Impact on Student Learning. Routledge. Retrieved from Http://Books.Google.Com.

[2]. Dionys, D. (2012). Introduction of ICT and Multimedia into Cambodia's Teacher Training Centres. Australasian Journal of Educational Technology, 28(6), 1068–1073.

[3]. Gikonyo, N. W. M. (2012). Factors Influencing University Managers' Participation in Distance Education: A Case of Public Universities in Kenya. University of Nairobi, Kenya. Retrieved from Http://Erepository.Uonbi.Ac.Ke.

[4]. Girgin, U., Kurt, A. A., & Odabasi, F. (2011). Technology Integration Issues in a Special Education School in Turkey. Cypriot Journal of Educational Sciences, 6(1). Retrieved from Http://Search.Ebscohost.Com.

[5]. Hoyles, C., & Lagrange, J.-B. (2009). Mathematics Education and Technology: Rethinking The Terrain. Springer. Retrieved from Http://Link.Springer.Com.

[6]. Jimoyiannis, A., Tsiotakis, P., Roussinos, D., & Siorenta, A. (2013). Preparing Teachers to Integrate Web 2.0 in School Practice: Toward a Framework for Pedagogy 2.0. Australasian Journal of Educational Technology, 29(2). Retrieved from Http://Www.Ascilite.Org.Au.

[7]. Khan, M., Hossain, S., Hasan, M., & Clement, C. K. (2012). Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Bangladesh. International Journal of Instruction, 5(2). Retrieved from Http://Search.Ebscohost.Com.

[8]. Laborde, C., & Strä\S Ser, R. (2010). Place and Use of New Technology in the Teaching of Mathematics: ICMI Activities in the Past 25 Years. ZDM, 42(1), 121–133.

[9]. Lee, M.-H., & Tsai, C.-C. (2010). Exploring Teachers' Perceived Self Efficacy and Technological Pedagogical Content Knowledge with Respect to Educational Use of the World Wide Web. Instructional Science, 38(1), 1–21.

[10]. Lim, C. P., & Chai, C. S. (2008). Teachers' Pedagogical Beliefs and their Planning and Conduct of Computer-Mediated Classroom Lessons. British Journal of Educational Technology, 39(5), 807–828.

[11]. Lim, C. P., & Pannen, P. (2012). Building the Capacity of Indonesian Education Universities for ICT in Pre-Service Teacher Education: A Case Study of a Strategic Planning Exercise. Australasian Journal of Educational Technology, 28(6), 1061–1067.

[12]. Miles, S., & Singal, N. (2010). The Education for All and Inclusive Education Debate: Conflict, Contradiction or Opportunity? International Journal of Inclusive Education, 14(1), 1–15.

[13]. Mishra, P., & Koehler, M. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. The Teachers College Record, 108(6), 1017–1054.

[14]. Otienoh, R. O. (2010). The Issue of Large Classes in Kenya: The Need for Professional Support for Primary School Teachers in School Contexts. Journal of International Studies in Educational Administration, 38(2), 57–72.

[15]. Parkay, F. W., Stanford, B. H., & Gougeon, T. D. (2010). Becoming a Teacher. Pearson/Merrill. Retrieved from Http://Www-Fp.Pearsonhighered.Com.

[16]. Peeraer, J., & Van Petegem, P. (2011). ICT in Teacher Education in An Emerging Developing Country: Vietnam's Baseline Situation At The Start of "The Year of ICT." Computers & Education, 56(4), 974–982.

[17]. Scheg, A. G. (2014). Reforming Teacher Education for Online Pedagogy Development. IGI Global. Retrieved from Http://Books.Google.Com.

[18]. Syfers, B. J. (2010). The Pedagogical Use of ICT in Grade Eight Natural Science Classes in South African Schools/Jerome Benjamin Syfers. Retrieved from Http://Dspace.Nwu.Ac.Za.

[19]. Zohar, A., & Schwartzer, N. (2005). Assessing Teachers' Pedagogical Knowledge in the Context of Teaching Higher-Order Thinking. International Journal of Science Education, 27(13), 1595–1620.