UNIVERSITI PUTRA MALAYSIA

PROFESSIONAL DEVELOPMENT NEEDS ANALYSIS OF SECONDARY MATHEMATICS TEACHERS IN ZANZIBAR, TANZANIA

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Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

July 2013

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DEDICATION

This research is dedicated to my late father bwana Shkeily, my lovely husband Mohammed Sheikh and my kids Walidah, Waleed, Khaleilah, and Khaleel who always trust that *it was possible* and finally *become possible,* Alhamdu lillah. May Allah forgive our sins and grant us Jannat.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirements for the Degree of Masters of Science

PROFESSIONAL DEVELOPMENT NEEDS ANALYSIS OF SECONDARY MATHEMATICS TEACHERS IN ZANZIBAR, TANZANIA

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Chair : Associate Professor Rohani Ahmad Tarmizi, PhD
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Teacher's professional development needs analysis is the systematic process to examine the strengths and weaknesses of teachers regarding mathematics teaching in their career development as professional mathematics teachers. Analysis on mathematics teachers professional development needs leads to improvement of teacher knowledge, teacher practice and thus student outcomes on mathematics performance.

This study aimed to investigate professional development needs of secondary school mathematics teachers in Zanzibar, Tanzania which is located in East Africa. Specifically, this study assessed professional development of mathematics teachers in Zanzibar in relation to current mathematics education curriculum and its implementation.

The descriptive research design was employed and two types of survey data were obtained through administering of questionnaire and also interviews. Total number of 191 (54.41 %) of mathematics teachers in Zanzibar from 78 secondary schools were stratified cluster sampled from all (10) districts. Mathematics Teacher Professional Development Needs Analysis questionnaire was used to access information on seven professional development subscales namely, planning of mathematics instruction, delivering mathematics instruction, managing mathematics instruction, self-improvement in pedagogical knowledge, self-improvement in content knowledge, communication skills in English Language, and use of Information Communication and Technology (ICT) in mathematics teaching.

The findings of the research show that all subscales were at moderate need with mean values ranging from 3.16 to 3.49, except on teacher self-improvement of content knowledge subscale which showed strong need (mean=3.54, SD=.49). The top needed subscale of professional development needs was on self-improvement in content knowledge (mean=3.54, SD=.49) followed by use of ICT in mathematics teaching

(mean=3.49, SD=.5). The relatively least needed subscales were aspect on delivery of mathematics instruction (mean=3.16, SD=.44) and planning of mathematics instructions (mean=3.20, SD=.51).

Comparison of mathematics teacher professional development need subscales on years of teaching experience shows that only five subscales were statistically significant different (using ANOVA test). The test statistics for subscales are as follows: *Planning mathematics instruction*, F (3, 187) = 5.708, p = 0.001, *delivering mathematics instruction*, F (3, 187) = 3.309, p=0.02, *use of ICT in mathematics teaching* needs, F (3, 187) = 3.48, p=0.017, *teacher self-improvement on pedagogical knowledge*, F (3, 187) = 3.569, p=0.015 and *teacher self-improvement on content knowledge*, F (3, 187) = 4.323, p =0.006. On the other hand, there were no statistically significant differences for the remaining subscales: *Managing mathematics instruction*, F (3, 187) = 1.611, p =0.611 and *communication skills in English Language* need, F (3, 187) = 2.301, p=0.079.

In addition, mathematics teachers' professional development needs subscales were also compared on school locality (rural and urban) and gender using independent t-test. The findings showed that there was significant difference in planning of mathematics instruction subscale, t (189) = -2.14, p = 0.03 between teachers in rural and urban locality. In addition, there was significant difference in mathematics teachers professional development needs on delivering of mathematics instruction, t (189) = -2.34, p =0.02.

The descriptive analysis further indicates that the dominant constraints for mathematics teachers professional developments were *limited professional development courses, seminars and workshops* whereby 84 (44.0%) respondents agreed to the matter, followed by *lack of financial support* whereby 59 (30.4%) agreed on it, and on *time conflicts in which* 16 (8.4 %) agreed on the matter.

The results generated from this study provide an extensive assessment of mathematics teachers professional development needs for Zanzibar, Tanzania. This is a milestone regarding to the quality of mathematics education in Zanzibar and Tanzania at large, which is one of the engine of the country's sustainable development specifically in developing mathematically literate and competent citizen.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan Ijazah Master Sains

ANALISIS KEPERLUAN PERKEMBANGAN PROFESIONAL GURU MATEMATIK SEKOLAH MENENGAH DI ZANZIBAR, TANZANIA

Oleh

SITI HAMAD MOHAMED

Julai 2013

Pengerusi: **Profesor Madya Rohani Ahmad Tarmizi, Ph.D**
Fakulti: **Institut Penyelidikan Matematik**

Keperluan analisis perkembangan profesional guru adalah proses sistematik untuk mengkaji kekuatan dan kelemahan guru-guru dalam pengajaran matematik bagi pembangunan kerjaya mereka sebagai guru matematik profesional. Analisis pembangunan profesional guru matematik diperlukan untuk peningkatan pengetahuan guru, amalan guru dan pencapaian pelajar terhadap prestasi matematik.

Kajian ini bertujuan untuk mengkaji keperluan perkembangan profesional guru matematik sekolah menengah di Zanzibar,Tanzania yang terletak di Afrika Timur. Khususnya, kajian ini bertujuan untuk menilai pembangunan profesional guru-guru matematik di Zanzibar berhubung dengan kurikulum matematik semasa dan pelaksanaannya.

Reka bentuk kajian ini menggunakan pendekatan deskriptif dan dua jenis data kajian diperolehi melalui soal selidik dan juga temubual. Sampel kajian terdiri daripada 191 guru matematik (54.41 %) daripada guru matematik di Zanzibar daripada 78 buah sekolah menengah dalam semua daerah (10). Soal selidik telah guna untuk mendapatkan data analisis perkembangan profesional guru matematik tentang tujuh sub-skala perkembangan profesional iaitu, perancangan pengajaran matematik, penyampaian pengajaran matematik, pengurusan pengajaran matematik, peningkatan diri dalam pengetahuan pedagogi, peningkatan diri dalam pengetahuan kandungan, kemahiran berkomunikasi dalam Bahasa Inggeris, dan penggunaan teknologi maklumat dan komunikasi (ICT) dalam pengajaran matematik.

Hasil kajian menunjukkan bahawa semua sub-skala adalah pada tahap keperluan sederhana dengan nilai min antara 3.16 - 3.49, kecuali pada peningkatan diri guru terhadap pengetahuan kandungan subskala yang menunjukkan keperluan yang kukuh (min = 3.54, SD = .49). Tahap paling tinggi diperlukan bagi subskala perkembangan profesional adalah pada peningkatan diri dalam pengetahuan kandungan (min = 3.54,

SD = .49), diikuti oleh penggunaan ICT dalam pengajaran matematik (min = 3.49, SD = .50). Sub-skala yang agakkurang diperlukan adalah aspek dalam penyampaian pengajaran matematik (min = 3.16, SD = .44) dan perancangan pengajaran matematik (min = 3.20, SD = .51).

Perbandingan perkembangan profesional guru matematik berdasarkan tahun pengalaman mengajar menunjukkan hanya lima sub-skala mencapai kesignifikanan (dengan menggunakan ujian ANOVA). Statistik ujian bagi setiap subskala adalah seperti berikut: Perancangan pengajaran matematik, $F (3, 187) = 5.708$, $p = 0.001$, pengurusan pengajaran matematik, $F (3, 187) = 3.309$, $p = 0.02$, penggunaan ICT dalam keperluan pengajaran matematik, $F (3, 187) = 3.48$, $p = 0.017$, peningkatan diri guru kepada pengetahuan pedagogi, $F (3, 187) = 3.569$, $p = 0.015$ dan peningkatan diri guru dalam pengetahuan kandungan, $F (3, 187) = 4.323$, $p = 0.006$. Sebaliknya, tiada perbezaan statistik yang signifikan untuk subskala yang selebihnya: Pengurusan pengajaran matematik, $F (3, 187) = 1.611$, $p = 0.611$ dan kemahiran komunikasi yang memerlukan Bahasa Inggeris, $F (3, 187) = 2.301$, $p = 0.079$.

Di samping itu, perkembangan profesional guru-guru matematik juga dibandingkan berdasarkan lokasi sekolah (bandar dan luar bandar) dan jantina dengan menggunakan *independent t-test*. Hasil kajian menunjukkan terdapat perbezaan yang signifikan bagi subskala perancangan pengajaran matematik $t (189) = -2.14$, $p = 0.03$ antara guru-guru di kawasan bandar dan luar bandar. Di samping itu, terdapat perbezaan yang signifikan dalam keperluan perkembangan profesional dalam menyampaikan pengajaran matematik, $t (189) = -2.34$, $p = 0.02$.

Analisis deskriptif selanjutnya menunjukkan bahawa kekangan yang dominan bagi perkembangan profesional guru matematik adalah *kekurangan kursus-kursus pembangunan profesional , seminar dan bengkel* yang menunjukkan 84 (44.0%) responden bersetuju dengan perkara itu, diikuti oleh kekurangan sokongan kewangan yang menunjukkan 59 (30.4%) bersetuju, dan berhubung dengan konflik masa pula menunjukkan 16 (8.4%) responden bersetuju mengenai perkara itu.

Hasil keputusan kajian ini memberi penilaian yang menyeluruh terhadap keperluan perkembangan profesional guru matematik di Zanzibar, Tanzania. Ini merupakan satu kejayaan tentang kualiti pendidikan matematik di Zanzibar dan Tanzania pada umumnya, yang merupakan salah satu jentera pembangunan mapan negara khususnya dalam membangunkan warga celik matematik dan berwibawa.

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I would like to thank all mathematics teachers who were participants in my research study whose willingness to share their views and vulnerabilities in such an open and revealing manner has offered me insights into the complex system of professional development.

I would like to thank my lovely husband Mohammed Sheikh, and our children, Walidah, Khaleilah, Waleed and Khaleel for their continual support and encouragement throughout my stay in Malaysia, career in education and during the long duration of this research and for their patience and words of wisdom.

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I certify that a Thesis Examination Committee has met on 12 July 2013 to conduct the final examination of Siti Hamad Mohamed on her thesis entitled "Professional Development Needs Analysis of Secondary Mathematics Teachers in Zanzibar, Tanzania" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirements for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

PD	Professional Development
ICT	Information Communication Technology
NTRC	National Teachers Resources Center
MDGs	Millennium Development Goals
O-level	Ordinary level
A-level	Advanced level
CSEE	Certificate of Secondary Education Examination
MOEVT	Ministry of Education and Vocational Training
NECTA	National Examination Council of Tanzania
ZEDP	Zanzibar Education Development Policy
ANOVA	Analysis of Variance
STIN	The Science Teacher Inventory of Needs
SD	Standard Deviation
PCK	Pedagogical Content Knowledge
MKUZA	Zanzibar National Strategy regarding to Poverty Reduction

CHAPTER 1

INTRODUCTION

1.1 Background of study

In recent decade, there has been increasing changes in educational reforms in mathematics education around the world. Many countries for instance, United States, Australia, Hong Kong SAR, and Mainland China focus on effective aspects of mathematics teaching and learning. Similarly, European countries reconstruct mathematics teaching and learning practices. In Australia, schools are obliged to focus on problem solving and critical thinking skills, adaptability and digital literacies. The Australian Government developed a Quality Teacher Program focusing on teacher professional development in mathematics with teachers as active learners. Altogether, the concept of professional development of mathematics teachers is central to the reforms (Lieberman and Pointer Mace, 2008).

In Tanzania, education reforms started in 1995 and extended to 1997. Then, the focus was on enrolment expansion, quality improvement, capacity building, educational research and institution arrangement strengthening (Chediel, 2009). In addition, the mathematics education reform focused mainly on mastery of content knowledge of basic and additional mathematics for ordinary level secondary education, pedagogical skills in teaching mathematics, competencies on action research for improving teaching and learning of mathematics and application of entrepreneurship skills using mathematics knowledge and professional development of teachers (Ministry of Education and Vocational Training [MoEVT], 2011).

1.1.1 Professional development

Professional development studies such as by Ganser (2000) and Buczynski and Hansen (2010) suggest that professional development involves workshops, summer schools, professional meeting, mentoring, peer collaboration, observations and after school seminars to increase content knowledge and promote self-efficacy. In the context of teacher education, professional development equips teachers with knowledge, tools and resources to improve instruction quality. In the context of professional development the teachers are considered as constructors of knowledge and transformers of culture in order to be rigorous learning opportunities for the teachers (Feiman-Nemser, 2001). Hence professional development of teachers should be reflective of a coherent and related to the current curriculum. In addition, professional development deals with intellectually superficial, disconnected from deep issues of curriculum and learning, fragmented and

non-cumulative (Ball & Cohen, 1999). However, this argument does not explain reasons behind the said superficiality and disconnection of professional development to curriculum and learning. Certainly, teacher professional development is a vital concept because it focuses to support teachers in action in order to improve performances.

Despite its necessity to the improvement of mathematics teaching, there is little information about contributing factors to effective mathematics and science professional development (Sparks & Loucks-Horsley, 1990). Elsewhere, Villegas-Reimers (2003) posited financial gain of the teachers as a result of participating in professional courses, positive impacts on teachers' beliefs and practices, improvement in students' learning and consequently improved implementation of the educational reforms as importance of professional development.

In Tanzanian context, the question of professional development has not been given proper attention (Komba & Nkumbi, 2008). However, the country has been engaged on implementing numerous educational development projects to meet its economic challenge. A good example was the Primary Education Development Program (PEDP) which focused on students' enrolment expansion, teachers' recruitment and deployment, and construction of classrooms and improving sanitary status (MoEVT, 2011). Therefore, there is a great need to incorporate the component on teachers' quality to add value to the projects (Komba & Nkumbi, 2008) and improve education services throughout the country.

1.1.2 Education in Tanzania and Zanzibar

The United Republic of Tanzania is located in East Africa and has a population of about 44.9 million with an annual growth rate of 2.6 (National Population and housing census, 2012). The rate of population increase is almost linear in Tanzania. Tanzania is one of the most relatable examples of a country where earlier efforts to get all children into primary schools yielded little apparent benefit in the long run.

Zanzibar is semi-autonomous part of the United Republic of Tanzania. It has its own Government, a legislative assembly known as the House of Representatives, the Executive, headed by the President of Zanzibar and its own Judiciary System. Recent census of the year 2012 reveals that Zanzibar population has reached 1.3 million peoples (National Population and housing census, 2012).

The Zanzibar education policy states that basic education is compulsory and free for all. This is stated in the Education Act No. 6 of 1982 amended in 1993, and the Zanzibar Education Policy of 1991 amended in 1995. However, Zanzibar people are encouraged to contribute financial resources to ensure that eligible children are enrolled, attend schools,

provided with quality and equal educational opportunities. Besides, the current Zanzibar Education Policy, 2006 highlights contribution of education towards National Economic Growth. It focuses to expand access and equity of basic education, and improve quality and effectiveness of education system.

Currently, the Zanzibar educational system is in transitional phase. It is based on the 7-2-2-2-3+ system: seven years of primary school, two years of lower secondary education, two years ordinary secondary education school, two years of secondary education advanced level and a minimum of three years of higher education. According to the education policy of 2006, the system will be phased-out by 2016, to adopt the new system of 2-6-4-2-3+. The initial two years in the system stands for pre-primary education, six years of primary education, four years of secondary education ordinary level, two years of secondary education advanced level and a minimum of three years of higher education (Zanzibar Education Policy, 2006).

Zanzibar education slogan "Education for all" emphasizes respect and adequate remuneration to teachers at all levels. In this case, remuneration includes proper training, continuous professional development and support to make teachers effective and prolific. It has been clearly pointed out that professional development and efficient management of teaching forces are crucial factors in raising relevance and quality of education in the country. A well qualified and motivated teaching force is one of the determinants for the promotion of high achievements (Zanzibar Education Development Program [ZEDP], 2006).

There is increasing concern that the failure rate in ordinary level (O-level) secondary schools in Zanzibar is not promising for many years. This problem is linked to presence of large classes which inhibit effective teachers' interactions with students during classroom sessions, including those with learning difficulties. Moreover, students' understanding is hampered by a low level of language proficiency (Rea-Dickins, 2010). In the context of mathematics and science subjects, students suffered from lack of qualified teachers, presence of considerable number of poorly trained existing teachers (Komba & Nkumbi, 2008). Previous study on need assessment on science subjects in Tanzania revealed that teachers' lack of awareness of context-based approaches including application of 'real-world' problem-solving activities in mathematics teaching/learning is a contributing barrier of educational development (Hamilton, Mahera, Mateng'e & Machumu, 2010)

Elsewhere, Kitta (2004) mentions five factors which have been contributing to poor mathematics performance in Tanzania. Such factors are unqualified teachers, inadequate relevant teaching materials, large class size, teachers' lack of subject matter knowledge and lack of opportunity to attend in-service programs among most of the mathematics teachers. There is also a concern that, the vast size of the country makes it difficult to provide appropriate in-service program to reach teachers in all schools.

Questions have also been raised about the quality of mathematics teachers. Prior to Kitta's (2004) study, Chonjo, Osaki, Possi, and Mrutu (1996) mentioned that the quality of mathematics teachers in the country is a severe problem. Due to the current expansion of student enrolment and influx of secondary schools, shortages of qualified mathematics and science teachers in Zanzibar are evident. For that reason, many schools have been employing unqualified ex-Form Six Leavers (students who have only completed advanced level education) to teach in secondary schools. In addition, employing non-professional people with unrelated backgrounds to teach mathematics also posed problems. Majority of them lack substantial subject matter knowledge, the knowledge of *what to teach*, and *how to teach* the subject matter effectively (Chonjo et al., 1996). This is in accordance with Shulman (1986) who mentioned that pedagogical content knowledge, which is a special blending of subject matter knowledge and pedagogical knowledge is necessary for effective teaching (Shulman, 1986). Therefore, taking the ex-form six leavers may pose problems in maintaining effective teaching and learning for the Tanzania learners. For that reason, teachers' professional development needs is evidently required in order to fill the gap of existing pedagogical and content skills among secondary schools mathematics teachers in Zanzibar, specifically, for those who were employed based on their form six certificates.

Teachers' progress is an essential component in educational development. To get qualified individual teachers majoring in mathematics and science teaching is a serious challenge in Malaysia (Osman, Halim & Meerah, 2006). A similar scenario is also true in Tanzania (Hamilton et al., 2010). For this reason, effective professional development programs should be designed to expose teachers into new teaching and learning experiences and strategies in order to help students learn in new ways. In practice, this requires that teachers' needs assessment be identified specifically, considering the gaps in the form of teachers' strengths and weakness (Lee, 2001; Shulman, 2005).

1.1.3 Needs assessment

Central to the concept of education, needs assessment is the process of gathering and analyzing information resulting from identified needs of students and teachers and other educational stakeholders in the societies. This process is used to determine weakness and strengths of educational system such as students overall achievement and teachers training. It focuses on future needs of local, regional and national educational systems in the context of policy formulation, analysis for useful decision actions such as planning or remediation to improve the situation. It has been shown that, the need assessment of professional development is based on three trends, namely, poor students' achievement, bottom-up reform effort and new view in teaching and learning (Sultana, 2004). In essence, accurate data should be gathered and used to plan a successful program for mathematics teachers (Rossett, 1987). Besides, it serves as an important initial step in curriculum design, improvement of teaching materials, learning activities, communication skills and program evaluation strategies. Collectively, there is an inspiring amount of research on needs analysis in the teaching of mathematics and science (for example

AbuBakar & Tarmizi, 1995; Kitta, 2004; Osman, et al., 2006; Quan-Baffour, 2007; Zakaria, Daud, & Meerah, 2009).

A study conducted on Malaysian teachers needs assessment, indicate that teachers were not satisfied to perform clerical tasks, write lesson plans, assign student grades, communicate with parents, hence carry less weight for teaching of science and mathematics. It is also reported that creativity in teaching science and mathematics, update knowledge in application of science and mathematics, and uses of technology are crucial components in both science and mathematics teaching. Lack of teaching experience for teachers and weaknesses in technical areas are named as needs in their professional development (AbuBakar & Tarmizi, 1995).

Professional development needs for mathematics teacher have also been addressed in the in-service training programs in Malaysia. In Malaysia, in-service programs have been focusing on technology integration, method of teaching and remediation of low achievers (Zakaria, Daud & Meerah, 2009). It is also commented that on planning for teaching, in-service programs consideration should be given to most needed areas since providing the same program for all teachers may not meet the needs of all teachers.

Elsewhere, it is presented that teachers' need professional development are focused on effective teaching methods, classroom management, alternative ways to assess students, and preparation of lessons for effective teaching (Quan-Baffour, 2007). Most teachers depend on in-service programs to enhance their skills. Since, dissatisfaction on professional development program is high, it is important to ensure that high quality professional development program be conducted in order to benefit teachers (Baird & Rowsey, 1989). So far, however, there has been little discussion on mathematics teachers' needs in Zanzibar. Currently, most interventions practices in Zanzibar are short-term, often only one-off, and relatively lack the appropriate theoretical foundation. Hence careful planning and critical analysis of underlying presumptions are needed before conducting professional development programs.

1.2 Statement of problem

Zanzibar National long term development plan "vision 2020" states that quality education is a core component towards the country sustainable development. Education is the main engine to achieve quality human capital for the country. Therefore, the availability of qualified professional teachers, are deemed necessary for Zanzibar, particularly, for science and mathematics teaching and learning as the two subjects are critical in developing human capital for the country.

Currently, Zanzibar students' overall national examinations Certificate of Secondary Education Examination (CSEE) performance in mathematics is alarming. Massive failure in basic mathematics subject at ordinary level secondary schools is a common scenario in Zanzibar. For example, current results show that mathematics failure rates in the National Form IV Examinations in Tanzania from 2004, 2005, 2006, 2008 and 2009 were at 70%, 77%, 76%, 76% and 82 % respectively (Hamilton et al., 2010). In Zanzibar alone, the mathematics failure rate is more than 95% among the Form IV students for the year 2011 (NECTA, 2011). This high failure rate indicated severe shortcomings of Zanzibar education system. For instance, the quality of mathematics teachers in terms of content knowledge and pedagogical skills is problematic (Chonjo et al., 1996). The failure is also linked to failure among science and mathematics teachers to use scientific methodology for students' learning, lack of relevant and adequate teaching and learning resources, and presence of overcrowded classrooms (Kitta, 2004; O-Saki, 2004). In practice, the problem is magnified by lack of teachers' needs assessment and mathematics professional development programs (Hamilton et al., 2010).

Previous studies have focused more on Tanzania Mainland, rather than on Zanzibar, such as on the state of science education (O-saki, 2004) and on enhancing mathematics teachers' pedagogical content knowledge and skills (Kitta, 2004), and is not focused on mathematics teachers' needs assessment. For that reason, there is a significant gap in research on secondary school mathematics teachers' needs assessment in Zanzibar itself. Certainly, mathematics teachers' needs assessment is a cornerstone in the strengthening of the education system. Therefore, a study is necessary to assess the needs of mathematics teachers' professional development in Zanzibar. The findings from the research may provide steps in enhancing the Zanzibar educational strategies in improving the education sector, and support practical implementation of its *vision 2020*, which is geared to improve life standards.

So far, there has been little discussion on mathematics teachers' needs in Zanzibar. Currently, most interventions practices in Zanzibar are short-term, often only one-off, and relatively lack the appropriate theoretical foundation. Careful planning and critical analysis of underlying presumptions are needed before conducting professional development programs. Hence, this research would attempt on gathering information on mathematics teachers' needs related to professional developments in mathematics teaching, deemed important in ensuring well and theoretically sound intervention programs be conducted in Zanzibar, Tanzania.

1.3 Objective of study

The overall objective of this study is to assess and describe professional development needs of secondary school mathematics teachers in Zanzibar, Tanzania. In particular, the research seeks to understand what are the professional development needs of secondary

school mathematics teachers in relation to current mathematics education curriculum and implementation of teaching and learning.

Specifically, the objectives of this study are to:

1. Assess and describe the level of overall professional development needs of secondary school mathematics teachers in Zanzibar using seven subscales: planning of mathematics instruction, delivering mathematics instruction, managing mathematics instruction, self-improvement in pedagogical knowledge, self-improvement in content knowledge, use of Information Communication and Technology (ICT) , and communication skills in English Language;

2. Compare mathematics teachers' professional development needs using the seven subscales based on years of teaching experience at the secondary level in Zanzibar;

3. Compare mathematics teachers' professional development needs using the seven subscales based on differing school locality, namely, rural versus urban schools in Zanzibar;

4. Explore barriers faced by Zanzibar's mathematics teachers at the secondary level in their professional development; and

5. Compare the barriers faced by mathematics teachers at the secondary level in their professional development based on school locality (specifically, rural versus urban teachers).

1.4 Research questions

1. What is the level of overall professional development needs of secondary school mathematics teachers in Zanzibar?
2. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on planning of mathematics instruction?
3. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on delivering mathematics instruction?
4. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on managing mathematics instruction?
5. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on teacher self-improvement in pedagogical knowledge?

6. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on teacher self-improvement in content knowledge?
7. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on use of Information Communication and Technology (ICT)?
8. What is the level of professional development needs of secondary school mathematics teachers in Zanzibar on communication skills in English Language?
9. What is the difference in overall level professional development needs of secondary school mathematics teachers in Zanzibar based on number of years of teaching experience (1-10, 11-20, 21-30, 31-40 years)?
10. What is the difference in the seven subscales of professional development needs (i.e planning of mathematics instruction, delivering mathematics instruction, managing mathematics instruction, self-improvement in pedagogical knowledge, self-improvement in content knowledge, communication skills in English Language, and ICT) of secondary mathematics teachers in Zanzibar based on number of years of teaching experience (1-10, 11-20, 21-30, 31-40 years)?
11. What is the difference in overall level of professional development needs of secondary mathematics teachers in Zanzibar based on school locality (rural versus urban)?
12. What is the difference in level of professional development needs on the seven subscales of secondary mathematics teachers in Zanzibar based on school locality (rural versus urban)?
13. What are the barriers faced by secondary mathematics teachers in their professional development?
14. Is there any association between barriers faced by mathematics teachers in their professional development with school locality (rural versus urban)?

1.5 Significance of study

The findings of this study are anticipated to realize the existing gaps in mathematics teachers' professional development needs in secondary schools in Tanzania, Zanzibar in particular. This will contribute to theoretical understanding of issues on professional development related to mathematics teachers in the Islands. In addition, these findings can be extended to understanding professional development needs of Tanzania secondary mathematics teachers. Besides that, these findings lend its contribution for other subjects in Tanzania's curriculum as the assessment of professional developments can be perceived as general pedagogical aspects in teaching and learning. The identified professional development needs will be used as a model to improve teaching and learning of mathematics and performance of secondary students in other applied and basic science subjects at large. Further, the results will contribute to the body of knowledge by understanding the contribution of the key parameters, such as teaching experience, and ICT integration in the teaching/learning mathematics.

The data derived from this study will also be very useful in the long term formulation of education policy and sustainable decisions of the country. Furthermore, the results will be useful to the Ministry of Education, Vocational Training and secondary schools, in strengthening in-service programs which encourage and supplement contextual knowledge for secondary school mathematics teachers.

The results may be used to inform policy makers, professional development organizers, school principals and mathematics teachers of the barriers facing mathematics teachers in secondary schools. Thus, general or specific plans of intervention can be conducted in order to minimize the mass failure of mathematics students in the country. With the knowledge of professional needs of mathematics teachers, teachers can initiate efforts to collaborate with each other towards improvement of mathematics learning and be empowered towards improving mathematics learning.

1.6 Limitation of study

The findings of this present research are limited to the secondary schools teaching of mathematics in Zanzibar, Tanzania. The situation and data may vary for secondary schools in other regions in Tanzania which may face different teaching and learning environments, life styles and standards, economic backgrounds, etc.

Findings of this study will also shed light on the constraints due to communication infrastructure factors such as unreliable postal services, internet access/connections and even rough (untarmac) roads especially during rainy seasons. Hence, another key limitation of this study is in terms of the constraints faced by this study, which impeded data collection to some parts of the pre-selected schools in the sampling frame. There were five schools, that either did not provide any responses at all, or a few of the mathematics teachers were absent during the survey.

Lastly, professional development needs have been limited to those aspects or scales as specified in the questionnaire. The use of questionnaire and relying on teachers' ratings of each of the professional development needs, may not be exclusive. A complete picture may require further descriptions based on interview protocols of secondary mathematics teachers and also observations of their mathematics teaching practices in the classrooms.

1.7 Definitions of the terms

The following are definitions of terms or concepts measured in this study.

1.7.1 Professional development needs

Professional development is referred as the sum of all activities that enhance teacher's knowledge, skills, attitudes and beliefs toward the teaching and learning process (Ganser, 2000). It is the combination of formal and informal educational development throughout ones' career from pre-service teacher education to retirement (Fullan, 2001). The focus on professional development needs assessment is to gain insight into the quality of teaching and learning mathematics in schools, and hence educational improvement can be undertaken (Kitta, 2004).

In this study, mathematics teachers' professional development needs refer to activities that enhance professional career growth on planning, managing, delivering mathematics instructions, teacher self-improvement on mathematics pedagogy and content knowledge, communication skills in English Language, and use of Information Communication and Technology (ICT) in teaching mathematics. Therefore, professional development needs of the teachers are all activities that teachers call for, depending on different items selected on each sub-scale of professional development, that when obtained, may help them to be more knowledgeable and competent in their job. For each item based on the seven subscales solicited, teachers were asked to rank to what extent the particular item was needed (see Appendix A). For each item, rank of 'greatly needed' indicates that the item is highly needed whilst rank of 'not needed' indicates the teachers do not need any assistance related to the item. The following subsections focus on each subscale of professional development needs examined in this study.

1.7.1.1 Professional development needs on planning mathematics instruction

Professional development needs on planning mathematics instruction refers to the mathematics teachers' development needs on statement of instructional objectives that guide mathematics instruction, this guideline determines the direction of teachers and students where they are moving, how they reach the target, and whether they have achieved the goal (Levine & Moreland, 1989). Planning describes how a teacher intends to deal with a specific area of content during specific time (Lorber & Pierce, 1990). The need of science teachers participating in professional development must be assessed prior planning of institution activities (Rubba, 1981). This may also applied to mathematics teachers. Effective professional development for science and mathematics teachers should involve both planning and implementation of in-service programs for sustainable teaching professional career. AbuBakar (1984) modified a Science Teachers Inventory of Needs

(STIN) composed of seven categories including the one dealt with planning science instruction which is also suitable for mathematics instruction. The category consisted of seven items.

For this study, professional development needs on planning of mathematics instruction consider the planning task of the mathematics teachers such as planning mathematics instruction using students' readiness data, selection of instructional materials, preparing appropriate methods, resources and teaching learning environment. In this study, a 10-items rating scale, modified and adapted from STIN, was used to measure the level of professional development needs of secondary school mathematics teachers on planning mathematics instructions (Appendix A, Section IIA).

1.7.1.2 Professional development needs on delivering mathematics instruction

Professional development needs on delivering mathematics instructions refers to the mathematics teachers' development needs on presentation of mathematics content to class as written/presented in instructional plan of a unit (Amstrong & Savage, 2002). Therefore, delivering classroom mathematics instruction depends upon teachers' creativity, reinforced by courage of inquiry and discovery. This will lead into harmony the relationship between students, teachers and the subject (Amstrong & Savage, 2002), thus it is an essential component for mathematics teacher professional needs. The STIN developed by Zurub (1982) for Jordanian secondary level science teachers consisted of several categories including delivering science instruction. STIN modified by AbuBakar (1984) also included delivering science Instruction category to assess the professional needs of science teachers of secondary schools in Malaysia which consisted of 18 items. These items are also suitable for mathematics instruction.

For this study, professional development needs on delivering mathematics instruction are based on appropriate methods and techniques in teaching, and uses of resources to support mathematics learning. Seventeen items rating scale modified from Science Teachers Inventory of Need was used to measure level of professional development needs of secondary school mathematics teachers on delivering mathematics instructions (Appendix A, Section IIB).

1.7.1.3 Professional development needs on managing mathematics instruction

Professional development needs on managing mathematics instructions refers to the mathematics teachers' development needs on a number of factors including the classroom leadership, facilitation of student motivation towards mathematics, arrangement of physical environment for mathematics teaching and learning, space and management of time and lessons (Amstrong & Savage, 2002). The management plays a significant role

on the effectiveness of teaching and learning mathematics and facilitates students' academic and social success, and is another key component in considering professional development of mathematics teachers. The STIN developed by Rubba (1981) for schools in Illinois and Zurub (1982) for Jordanian secondary level science teachers consisted of various categories including the one for managing science instruction. STIN modified by AbuBakar (1984) indeed included managing science instruction subscale to assess the professional needs of Science teachers of secondary schools in Malaysia which consisted of 10 items.

For this study, professional development needs on managing mathematics instruction consider the managing task of the mathematics teachers such as managing mathematics instructional budget, keeping students' records, maintaining students' disciplines and evaluating mathematics instructional effectiveness. A six items rating scale was modified from the Science Teachers Inventory of Needs was used to measure level of professional development needs of secondary school mathematics teachers on managing mathematics instructions (Appendix A, Section IIC).

1.7.1.4 Professional development needs on acquiring pedagogical knowledge

Professional development needs on acquiring pedagogical knowledge refers to the mathematics teachers' development needs on what teachers know about teaching, which is knowledge of classroom organization as well as management, knowledge of instructional models and strategies, and knowledge of classroom discourse and communication (Morine-Dershimer & Kent, 1999). Teachers' experience, personal beliefs and perceptions are synchronized in pedagogical knowledge. It is widely accepted that beliefs about teaching and learning will impact how mathematics teachers utilize their pedagogical knowledge (Roehrig, 2004). Therefore, improving of mathematics teachers' level of pedagogical knowledge is a cornerstone of professional development of mathematics teachers. Teachers' self-improvement was among seven categories by Rubba (1981), Zurub (1982) and followed by AbuBakar (1984), the latter of which included similar variables considered for teachers' self-improvement under the category of improving ones competency as a science teacher to assess the Professional Needs of Science Teachers of Secondary Schools in Malaysia. The category consisted of 16 items.

In this study, professional development needs on acquiring pedagogical knowledge refer to teachers' needs on improving their teaching strategies and skills, such as updating ones knowledge related to societal issues, updating carrier opportunities, background to curriculum development, philosophy of education. An eight items rating scale was modified from Science Teachers Inventory of Needs was used to measure level of professional development needs of secondary school mathematics teachers on acquiring pedagogical knowledge (Appendix A, Section IID).

1.7.1.5 Professional development needs on acquiring content knowledge

Professional development needs on acquiring content knowledge refers to the mathematics teachers' development needs on improvement of subject matter. According to Shulman (1986), content knowledge is the quantity and organization of knowledge that teachers possess (what teachers know about what they teach). It is the fact that the teachers' subject content knowledge determines their ability in facilitating students to learn the basic content of the subject. It has been noted that shallow content knowledge in mathematics teachers jeopardizes the growth of teaching career (Clarke, 1994). Teachers' teaching should integrate subject matter knowledge and pedagogical content knowledge (Loucks-Horsley, Hewson, Love & Stiles, 1998). Rubba (1981) followed by Zurub (1982) derived the teacher self-improvement as a category of teachers needs assessment. STIN by AbuBakar (1984) included in general to assess the Professional Needs of Science Teachers of Secondary Schools in Malaysia. Needs on acquiring content knowledge was basically derived from teachers' self-improvement under the item improving one's competency as a science teacher.

In this study, professional development needs on acquiring content knowledge refer to teachers' improvement on knowledge of mathematics, such as the need to update on mathematical knowledge, mathematical skills, computational reasoning, and computational skills. An eight items rating scale, modified from Science Teachers Inventory of Need was used to measure the level of professional development needs of secondary school mathematics teachers on acquiring content knowledge (Appendix A, Section IIE).

1.7.1.6 Professional needs on information communication and technology (ICT)

Professional development needs on information communication and technology refers to the mathematics teachers' development needs on tools, which enable them to get information, to communicate with others, or to have an effect on the environment, using electronic or digital equipment (Mohanty & Vohra, 2006). ICT describes the set of technologies with specific application, which varies in purpose and scope between the subject contexts. According to Loveless and Ellis (2001) and Williams, Coles, Richardson, Wilson & Tuson (2000), integration of ICT in teaching adds a special value in teachers' development and teaching practice. STIN by AbuBakar (1984) included items on the use a computer to manage instruction, when assessing the Professional Needs of Science Teachers of Secondary Schools in Malaysia. The items were derived from the categories managing science instruction which consisted 11 of items, and delivering science instruction which consisted of 19 items (AbuBakar, 1984).

In this study, professional development needs on information communication and technology refer to teacher desired ICT knowledge and skills for helping them to be more effective in teaching mathematics. These include arranging physical environment

appropriate for use of ICT, use of audio visual equipment, and using computer and teaching machine in teaching mathematics. A 7-items rating scale, modified from Science Teachers Inventory of Need was used to measure the level of professional development needs of secondary school mathematics teachers on information communication and technology (Appendix A, Section IIF).

1.7.1.7 Professional development needs on communication skills

Professional development needs on communication skills refers to the mathematics teachers' development needs on the process by which a teacher stimulates meaning in the mind of students through verbal and/or non verbal messages (Mc-Croskey, Richmond & McCroskey, 2006). It is a crucial phenomenon that bridges between a knowledgeable teacher and willing student (McCroskey et al., 2006) or among students (Cooper & Simonds, 1999). The teacher must not only conversant in content knowledge but also skills of conveying clear messages to the students (Cooper & Simonds, 1999). STIN by AbuBakar (1984) included the items on communicating student science learning progress to the student, administrators and parents, and the Professional Needs of Science Teachers of Secondary Schools in Malaysia on this matter, were assessed. The items were derived from the category of managing science instruction which consisted of 11 items AbuBakar (1984).

For this study, professional development needs on communication skills refer to the skills needed for conveying clear message to students, such as skills on delivering mathematics topics in English as a second language, communicate students' progress to administrators and parents, teaching students with limited English proficiency and improvement on teachers' communication skills. A 4-items rating scale, modified from Science Teachers Inventory of Needs was used to measure the level of professional development needs of secondary school mathematics teachers on communication skills (Appendix A, Section IIG).

1.7.2 Professional development barriers

Professional development barriers are difficulties experienced by teachers in accessing professional development opportunities (Merriam & Brockett, 1997). Three key kinds of barriers have been identified by the authors, namely, *situational, institutional, and dispositional barriers.* Situational barriers are those factors in the individuals' life circumstances at any given time, such as lack of time, awareness, financial support and home and job responsibilities. *Institutional barriers* are those practices, procedures and policies that place limits on opportunities for potential participants, for example, limited courses, unavailability of substitutes, bureaucracy, residency requirements and course scheduling. *Dispositional barriers* are relate to attitude and self-perceptions about one-self as a learner, which include confidence, negative experiences, anxiety, lack of interest, etc (Merriam & Brockett, 1997).

For this research, the list of constraints (such as financial support, time conflicts, awareness, interests, family responsibilities etc) was modified from the Missouri Professional Development Inventory of Needs used to determine barriers faced by the secondary mathematics teachers for their professional development. The teachers were required to rank and state three most professional development barriers from the list provided.

1.7.3 School locality

According to Pizzoli and Gong (2007), rural and urban locality may be explained by multidimensional approach by taking into account various components such as population size, agriculture activity, and human resources (lower skilled for rural and educated skill with respect to urban areas). For the Zanzibar Government context, rural schools are those located in remote areas with relatively few socio-economic activities and population, compared to urban schools. The schools are classified as *Urban* and *Rural* based on the location with respect to population and socioeconomic activities. Districts such as Wete, Chake Chake and Mkoani consist both rural and urban schools. Other Districts i.e North A, North B, South, Micheweni and Central consist rural schools while Urban and West Districts consist of urban schools.

1.8 Years of teaching experience

Years of teaching experience means the equivalent years of full-time teaching employment. Experience does not have to be consecutively through full-time teaching. For example, a teacher who teaches half-time for a full year can accumulate four years over eight school years. Teachers' years of experience is considered as a relevant factor in human resource policies, including compensation systems, benefits packages, and promotion decisions (Rice, 2010). As the experience gained over time, the knowledge, skills, and productivity of workers enhanced. Experience matters, but more is not always better. The impact of experience is strongest during the first few years of teaching; after which, marginal returns diminish (Rice, 2010). In this study, years of teaching experience means the cumulative years which the teachers served in effective teaching.

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