

Analyzing factors influencing mathematics pre-service teachers' enrollment choices in an ODL institution

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Abstract

Recruiting and retaining mathematics teachers is a matter of concern in many countries. This paper reports on a qualitative study of 56 pre-service teachers who enrolled in an open distance learning institution in one university in South Africa. The pre-service teachers were asked to provide reasons for why they chose to be mathematics teachers. The results showed that the pre-service teachers chose mathematics teaching because of passion, to instill the love of mathematics in their learners, love, understanding and enjoyment of teaching mathematics, value of mathematics, and appreciation of the nature of mathematics from their school days. The results of this study may have implications in increasing the retention of mathematics teachers in the profession.

Key words: *Mathematics pre-service teachers, open distance learning, career choice*

Introduction

Globally, there are concerns about the recruitment and retention of mathematics teachers (Department of Education, 2005; Stevenson, Dantley & Holcomb, 1999). Considerable evidence of teacher shortages in most countries especially in a specialized subject like mathematics exists (UNESCO, 2001). Thunberg (2009) maintains that in Sweden, like many other countries, there is a reduced interest for Mathematics, Science and Technology among the youth. Recruitment to teacher-training programmes and universities courses in these subjects as well as to engineering education is gradually lessening. A similar opinion was shared in the context of Australia (Stokes, 2007).

The HSRC report (2005) identifies various challenges in the supply of teachers in the South African context such as improved career opportunities which reduced the number of applicants who enter the education sector. This limited number of education graduates does not necessarily end up teaching Mathematics but joining other sectors. For instance, some educators are likely to seek employment in other fields where their teaching skills are valued, such as in training-related careers or marketing. Instances of an oversupply of teachers particularly in urban schools and an undersupply in rural schools are reported. Recruiting educators for rural schools predominantly in Physical Science and Mathematics is challenging because of lack of special amenities and the dismal teaching environment in many schools. Dawson (2007) reported on a wide shortage of qualified mathematics and science teachers in secondary schools. As the case in South Africa (HSRC report, 2005), there are also shortages of mathematics teachers particularly in rural areas of Australia (Stokes, 2007). A possible cause of mathematics and science teacher shortage is the increasing pattern in the international migration of teachers (HSRC, 2005).

The effective teaching and meaningful learning of Mathematics demands well qualified, innovative and dedicated teachers. There is considerable evidence that teachers' knowledge

and ability are associated with students' learning in the classroom (Stokes, 2007). Teacher education through open distance learning (ODL) has become popular to reduce teacher shortages through providing suitably qualified Mathematics teachers (Sebolai, 1997). The shortage of teachers can negatively influence the instruction of subject areas of Mathematics and Science leading to adverse effect on business and industry. Subsequently, the economic growth and global competitiveness of countries can be undermined. In support of this assertion the Cockcroft Report (1982) noted that there is no area of knowledge where a teacher has more influence over the attitudes as well as the understanding of learners than he/she does in Mathematics. During his/her professional life, a Mathematics teacher may influence the attitudes towards Mathematics of several thousand young people, and their career choices. It is therefore necessary that Mathematics should not only be taught to all students, but taught well. Consequently, the question that guided this research was: *What influenced pre-service teachers to enroll at an open and distance mode of teacher education offered by the University of South Africa (UNISA) to choose mathematics as their specialize teaching area?* Answers to this question may give educators and policy makers insight into how to attract and retain future mathematics teachers.

Literature Review

Various reasons for career choices have been provided in research reports. Some of the most important reasons given were prior considerations, career fit, and time for family and financial reward (Richardson & Watt, 2005). A further study by Richardson and Watt (2006) using a bigger sample revealed that the main factors that motivated students to become teachers were their abilities, the intrinsic value of teaching and the desire to make a social contribution, to shape the future and work with children or adolescents. Other reasons cited by Espinet, Simmons & Atwater (1992) included the opportunity to fulfill childhood ambitions of moulding students' minds. Working in industry was perceived as impersonal; they preferred to work with people. Others were influenced by the vacations associated with teaching. Roberson, Keith and Page (1983) reported of the influence of former teachers on career choice. Also many teachers made career decisions about teaching during high school. The 'desire to help others' came as a strong reason in Stoke's (2007) study. The subjects that teachers taught, was a very important consideration in their level of job satisfaction and thus lead to less resignations. If teachers are teaching outside their field of interest, it is possible that this could reduce their levels of satisfaction and thus can lead to resignation.

The results of the study of Nyaumwe, Brown & Dhliwayo (2004) on motives of pre-service teachers to train as mathematics and science teachers revealed four distinct factors namely, intrinsic motivation, condition of service, external factors, social and development factors. Among these factors, intrinsic factors such as (enjoyment of teaching, love for teaching, inborn talent for teaching, enjoyment of school environment and interest in subject matter) were found to be the most influential factors that attracted students to train as teachers. In the study of Dawson (2007), the most common reason (cited by more than 70% of the students) was a love or passion for Science or Mathematics. The next most common reason (23%) was previous success at school and/or university. The students in the study reported receiving high grades, or being told that they had an aptitude or talent for Science and

Mathematics. A desire to keep learning more about the fields of Science and Mathematics was also stated (9%) as luring some people into teaching. Having a good science or mathematics teacher was not cited as often although it was presumed that the passion for science and mathematics was partly as a result of school experiences.

Green & Grieve (2007) used a questionnaire to examine the factors that influenced the desire to become teachers of technology in Australia. The findings revealed that out of the 172 respondents who came from the workforce, a total of 93 (86 males and 7 females) had prior trade experience. A factor analysis of the attitudinal items set against a 4-point modified Likert scale produced three factors related to their decisions to become Technical and applied studies (TAS) teachers. The factors included: encouragement from members of the community, the influence of experiences in technology at school and a desire to teach. When a three stage regression model was created with the scale 'desire to teach' as the ultimate dependent variable, factors most strongly influencing the desire to teach included hobbies and interests prior to enrolment, encouragement from members of the community and the influence of experiences in technology at school. Whilst some of the factors that influenced choices in careers have been identified by previous research, the contribution of the present study is to extent the research to a new population, the open and distance learning (ODL) context.

Method

This research is within the descriptive paradigm (Cohen, Manion, Morrison, 2000) and aims to identify reasons that led mathematics pre-service teachers registered in the 2010 cohort to study mathematics education at UNISA, an ODL institution. The sample consisted of students who were at the different year levels in BEd Foundation, Intermediate and Senior phase, Further Education and Training (FET) and Postgraduate Certificate in Education (PGCE). All these students studied Mathematics as a teaching major which qualified them to teach Mathematics from Grades R-9 and Grades 10 to 12 upon completing the degree program. A questionnaire was found a suitable method in the qualitative investigation.

The questionnaire was structured to include a demographic section covering aspects of age, gender, qualification, the Matric (Grade 12) Mathematics symbol, other qualifications, current job, program enrolled for, present year of teaching practice, name of province and school location, among other things. It also sought information on the level of resources available at a school and opinion statements about their experiences during teaching practice. An open-ended question to state the reasons why they wanted to become mathematics teachers was included on the questionnaire.

The questionnaires were administered by post. A total of 100 questionnaires were sent out to students in their different course levels with a return of 56 completed questionnaires. The questionnaire was anonymous. A self-addressed envelope was included for return of the questionnaire by post.

Data analysis was inductive to allow patterns, themes, and categories to emerge (Patton, 2000). On receipt, the questionnaires were numbered and the responses were examined and recorded. Similar responses were grouped together into themes. The responses provided by the students were not differentiated into the different groups and year levels. The limitations of the data collection methods were in terms of the response rate. Some respondents did not provide any useful information. Due to the geographical location of the students, hand administration would not have been possible to facilitate a higher return

rate. Also interviews, which were not possible due to the geographical locations of the students, would have allowed probing to solicit further reasons for training as mathematics teachers. These limitations make the sample too small to make generalizations about career choices of students enrolled at Unisa. However, notable categories within this sample emerged. The results are presented next.

Findings and discussion

The findings of the study are discussed according to demographic data, age, matriculation symbols, current job, other qualifications and narrative statements.

Demographic information

The age of students in the sample used for this research is shown in Figure 1 below.

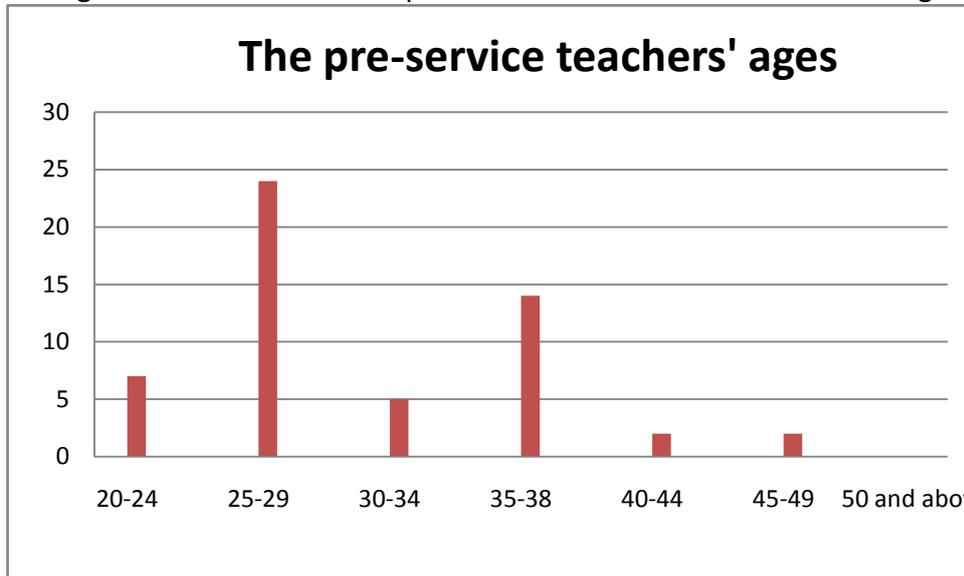


Figure 1: Pre-service teachers' ages

As can be seen in Figure 1, most pre-service teachers in the sample are between the ages of 25 and 29 (24) and 35-39 (14) years. There are very few student teachers above 40 years. This finding is surprising since one would have expected the beginning teachers to be more in the category of less than 24 years. However, the finding contradicts the demographic data from HEDA. As an ODL institution, the majority of UNISA students are expected to fall in the age range of above age 40 because in open education people of all age groups are expected to be enrolled. It should be noted that this result is not representative for all the different programs at UNISA where older students are found dominating degree programs.

Gender

There was almost an equal number of students as far as gender is concerned, 28 females and 26 male pre-service students in the sample studied. This finding defies the assertion in earlier times, of the stereotyping of mathematics as a male domain which was identified as a factor contributing to females' decisions not to persist with higher-level mathematics courses (Leder & Forgaz, 2003). Of note worthy is that this finding concurs with the 2011 registration at UNISA in the College of Education. Out of the total of 77 424 registered in the College of Education, 63 028 were female and 14 396 were male students.

Matriculation symbol

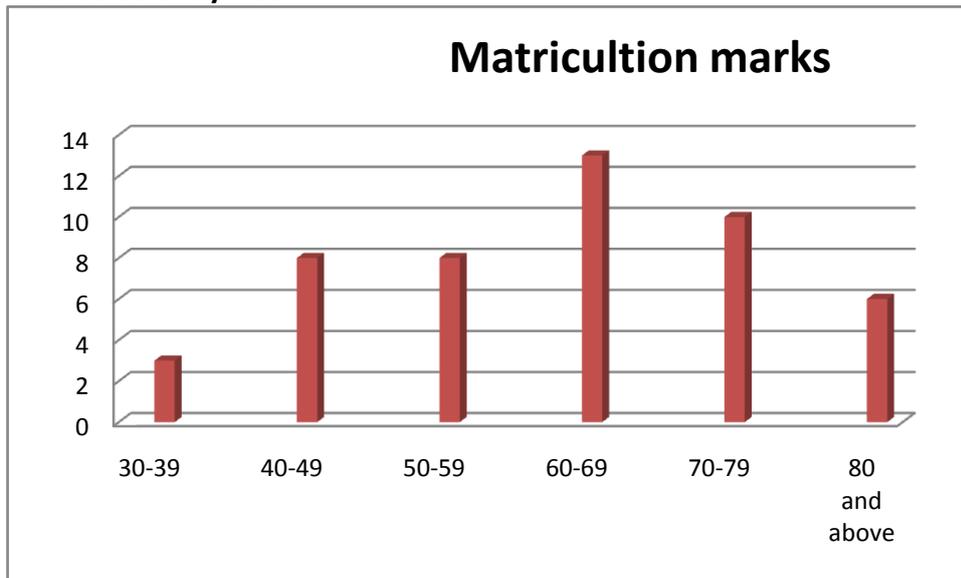


Figure 2: Matriculation symbols

As shown in figure 2 the majority of the pre-service teachers in this sample obtained Matric symbols in the average range of 60-69 percent followed by the range 70-79 percent and those who had symbols above 80 percent were only 6. The students enrolled had fairly good passes in Matric mathematics.

Current job

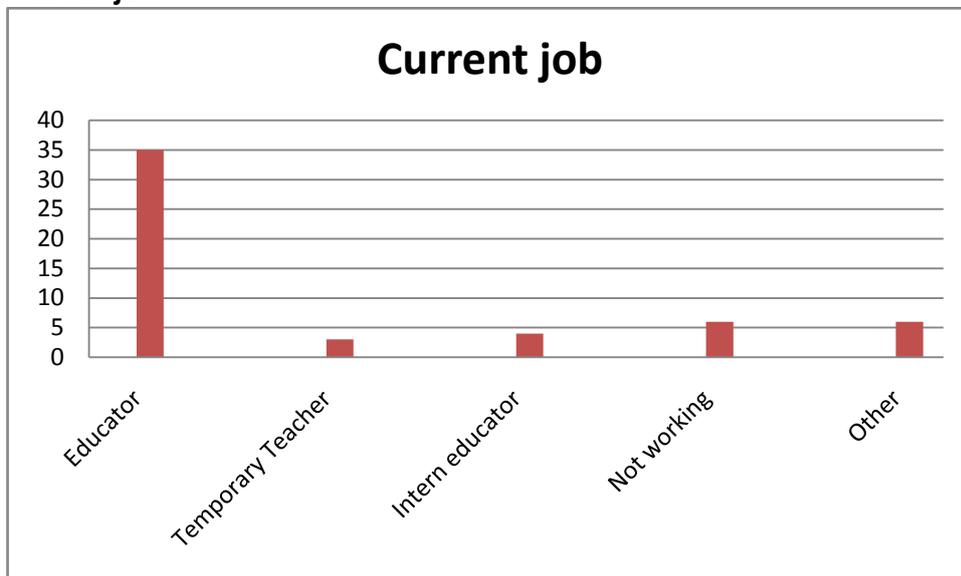


Figure 3: Current job

The current job of the majority of pre-service student teachers who responded to the questionnaire was teaching (35). It came as a surprise that only few pre-service teachers indicated that they enrolled for teaching to get a qualification because they already had one. These are the temporary teachers (3), intern educators (4), those who were not working were (6). Also, there were 6 other students who were doing other jobs like working

as a facilitator, secretary, broker, process controller and administration work. These were candidates who wanted to change their careers to teaching mathematics.

Other qualifications

Other qualifications that the pre-service teachers had included a Bachelor of Science degree in different other subjects like Physics and Mathematics, Biochemistry, Microbiology, Genetics, Computer Science, Commerce and Tourism, Bachelor of Science Honours in Chemistry, Applied Mathematics and Mathematics. One student had a Bachelor of Commerce in Managerial Accounting and another, a Master of Science in Risk Analysis. It was noted that some of the pre-service teachers held different other qualifications such as Security Certificate Grades C & D, Electrical N3, Diploma in Abet, Certificate in End User Computing, N4 (including mathematics), Mathematics 1 (University course, GCE 'A' level), Electrical Engineering, Marketing, and Diplomas in Agriculture.

Reasons for choosing mathematics teaching

Some of the common reasons given for choosing to become mathematics teachers were passion to instill the love of mathematics in their learners, love and enjoyment of teaching mathematics, aesthetic value of mathematics, and appreciation of the nature of mathematics from their school days. Examples of quotes are:

Theme 1: Passion for mathematics

A passion for mathematics as expressed by the pre-service teachers is shown in the following statements.

I have a passion for the subject and would like to inculcate/instill the same value in learners without disrupting my current income (Pre-service Teacher 9). Mathematics is the subject I am most passionate about and would like to inspire the learners (Pre-service Teacher 55)

I have a passion for maths and problem solving (Pre-service Teacher 30)

I have great passion for the subject and wish to instill the same to others (Pre-service Teacher 33)

As can be seen from the students they would like to instill, inculcate and inspire this passion into their learners.

Theme2: The love of Mathematics/ teaching Mathematics

The love for mathematics was the most common reason cited by 70% of the students in the study of Dawson (2007). In this study the love for the subject is shown by the following statements:

Because it is the subject I love most (Pre-service Teacher 51)

I love teaching. I love mathematics. It's fun (Pre-service Teacher 52)

I have a love for teaching Mathematics and hope to carry this into the mathematics classroom and my current job does not allow this (Pre-service Teacher 54).

Ek is baie lief vir wiskunde, ek kan leerders help (*I love Mathematics very much and I can help learners*) (Pre-service Teacher 10)

Looking at the above statements, the pre-service teachers were attracted to teaching because they love mathematics and also they love teaching mathematics in particular.

Theme 3 Understanding Mathematics and liking Mathematics

Understanding can be defined as a measure of the quality and quantity of connections that an idea has with existing ideas. Understanding is not an all-or nothing proposition. It depends on the appropriate ideas and on the creation of new connections, varying with each person. It exists along a continuum from relational understanding – knowing what to do and why– to an instrumental understanding – doing without understanding (Van de Walle, Karp, Bay-Williams, 2011; Skemp, 1978).

The statements that show that the pre-service teachers expressed the reasons that influenced them to choose to specialize in mathematics teaching are:

I like mathematics. I understand mathematics (Pre-service Teacher 35)

This is because of the knowledge I have and the problems facing students (Pre-service Teacher 31)

To make mathematics understandable to those that think it is difficult (Pre-service Teacher 25)

I understand it and if I explain to someone he/she understands what I am saying (Pre-service Teacher 2)

I like mathematics because it is practical, then I like to share my knowledge with learners (Pre-service Teacher 13)

It is because I like our children to get what I got from my school teacher in mathematics (Pre-service Teacher 44)

I like mathematics and would be humble to give a learner a best thing about mathematics (Pre-service Teacher 48)

I like mathematics and I wish to make my learners to like it and to pass it very well. (Pre-service Teacher 49)

A closer look at these statements shows that liking and understanding goes hand in hand. The pre-service teachers like mathematics because they understand it. They also expressed their liking of mathematics because it is practical discipline and they would like to share their knowledge with the learners and also make the learners love the subject.

Theme4: Enjoy teaching Mathematics

I enjoy teaching mathematics (Pre-service Teacher 15)

I enjoy mathematics as a person and would like to instill logical and critical thinking to our learners (Pre-service Teacher 26)

Because this is the subject I mostly enjoyed than other subjects (Pre-service Teacher 47)

I enjoy solving mathematics problems and want to let others know it (Pre-service Teacher 45)

I enjoy teaching mathematics and I want to see people prosper in doing maths. (Pre-service Teacher 41)

I enjoy mathematics, solving problems and helping learners understanding this fundamental subject (Pre-service Teacher 43)

It is regarded as a notoriously difficult subject, but I enjoy its challenges and its

importance which my current job does not offer (Pre-service Teacher 50).

Most pre-service teachers expressed that they chose to study Mathematics in the teacher training course because they enjoyed the subject when compared to other subjects in the

curriculum and that they liked to teach it. They enjoy solving mathematical problems and would like the learners to enjoy this subject too. Pre-service Teacher 50 who is one of the students who was involved in another job different from teaching, said 'It is regarded as a notoriously difficult subject, but I enjoy its challenges and its importance which my current job does not offer'.

Theme 5: Appreciation of the nature of mathematics from their school days

I loved it at school level (Pre-service Teacher 5)

I really liked maths even when I was still at school. It's my passion, even though I failed to do well during my grade 12 year. (Pre-service Teacher 22)

Because I love mathematics from high school (Pre-service Teacher 56)

I loved mathematics since I was in the primary level (Pre-service Teacher 32).

Theme 6: The nature of mathematics

It is quite fascinating and challenging (Pre-service Teacher 18)

It is an interesting subject with lots of challenges (Pre-service Teacher 27)

Maths is an interesting subject, and I like to make learners be good problem solvers in real life. (Pre-service Teacher 39)

It's a scarce subject which learners find difficult to do. I want to make it easier and clearer to learners (Pre-service Teacher 34)

Theme 7: To obtain a qualification

Some pre-service teachers are teachers already but would like to specialize as Mathematics teachers as can be seen with Pre-service Teacher 12, 'I am a science teacher (Gr 10-12) and mathematics and science 'go together', I enjoy logical rational subjects. Pre-service Teacher 42 is an example of a teacher who would like to obtain a teaching qualification 'to be professionally qualified'.

Theme 8: Value of mathematics

Other pre-service teachers took the opportunity of specializing in mathematics because of the value and usefulness in the economy and career options as indicated below:

It's the currency of science & technology and provides critical role for service (Pre-service Teacher 21)

I have realized that our economy needs engineers and doctors to develop (Pre-service Teacher 40)

Conclusion

From the study the reasons for student teachers to choose to be Mathematics teachers were varied. In this study even though the students were in other jobs they still felt a desire to train to be mathematics teachers as can be seen with Pre-service Teacher 54 "I have a love for teaching and hope to carry this into the mathematics classroom and my current job does not allow this" What drove some of the pre-service teachers to study to become mathematics teachers was passion. They wanted to inculcate this passion into their learners. By using emotive words such as, instill and inspire, they expressed the extent of their passions. They loved teaching and loved to teach mathematics, they understood and enjoyed mathematics and found it to be fun. The demographics of the data show that the

UNISA pre-service teachers are mature in terms of age. The results show generally good grades acquired by students enrolled (Figure 2).

The reasons given by the pre-service teachers to choose to teach Mathematics' are positive. This gives hope that the pre-service teachers are more likely to be retained in the teaching profession more so in the teaching of Mathematics. Some of the insights from this study are that selection methods need to be carefully developed to take into cognizance the motivation of pre-service teachers to enroll in teacher education programmes particularly in ODL contexts in order to maximize the recruitment of committed professionals.

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