Art. # 1465, 13 pages, https://doi.org/10.15700/saje.v38n2a1465

The factors influencing Mathematics students to choose teaching as a career

Michelle du Preez
Department of Education, University of the Free State, Bloemfontein, South Africa
dupreezmichelle1@gmail.com

Prompted by the poor state of mathematics education in South Africa and the shortage of competent mathematics teachers, this study sought to identify what factors influenced 40 Postgraduate Certificate in Education (PGCE) students at three universities in the Western Cape Province, with Mathematics as a major subject, to choose teaching as a career. The respondents were asked to articulate reasons for their career choice by answering an open-ended question and completing an internationally validated FIT-choice questionnaire. The motivations presented in the questionnaire are based on the concepts of Self-efficacy, Self-determination Theory (SDT) and Expectancy Value Theory (EVT). The research has shown that student responses regarding their motivations were remarkably consistent, regardless of the respondents' home language or social class. Student rating choices were based mainly on intrinsic motivations. The study concludes, therefore, that understanding student choices with respect to Mathematics teaching as a career will assist in the planning and management of the recruitment and retention of quality Mathematics teachers. It is clear from this research that when student teachers with intrinsic motivation are identified and recruited, they will be more likely to perceive teaching as a lifelong career choice.

Keywords: career choice; factors; mathematics teachers; motivation; recruitment; retention

Introduction

Why do Mathematics majors choose teaching as a career? This question lies at the heart of this inquiry and is important for several reasons.

First, there is clear evidence that far too few students choose teaching as a career and even fewer choose mathematics teaching as a speciality. There is a global shortage of STEM (science, technology, engineering and mathematics) teachers. A number of OECD (The Organisation for Economic Co-operation and Development) countries, including highly developed countries such as Australia and the USA, experience the shortage (Watt, Richardson & Pietsch, 2009:286–287). Newton, Jang, Nunes and Stone (2010:21–22) quote from the Council on Science and Technology and the Centre for the Future of Teaching and Learning in the USA that the three most critical problems in urban schools, serving mostly socially and economically disadvantaged pupils, are "... recruiting, preparing, and retaining high quality secondary mathematics and science teachers" (Newton et al., 2010:21). The National Development Plan (NDP) of the South African government of 2011 recognises the need for "competent, highly qualified and highly motivated" teachers, particularly in key areas like mathematics and the physical sciences, to be able to improve "education, training and innovation" (Van Broekhuizen, 2015:1, 30).

Second, the global need for STEM-related skills in careers and everyday life is rising, where the most affluent nations and developing countries such as China and India are required to keep economically abreast by growing their modern "knowledge based economies." Scholars affirm that the STEM disciplines are the "... drivers of technological advancement, innovation and provide the foundational infrastructure to secure a robust economic future" (Watt et al., 2009:285–286). Kennedy and Odell state that "[i]mproving teaching and learning in STEM education has become an economic factor in developing countries, emerging economies, and in long established economies such as Europe and the United States" (2014:248). Sufficient highly skilled science and engineering graduates are therefore also essential for the economic development of South Africa (Wolmarans, Smit, Collier-Reed & Leather, 2010:274).

Third, as Mathematics provides the grounding for all the STEM fields, the training of a sufficient number of competent Mathematics teachers is seen as a priority by governments and industry globally. Ingersoll and May (2010:2–3) state that the relatively poor USA educational performance, the minority achievement gap and lack of national economic competitiveness can be attributed to the diminishing number of qualified mathematics and science teachers. Evidence of current substantial teacher shortages in the USA is reported by Dee and Goldhaber. They state that the shortage is "highly concentrated by subject (e.g., mathematics, science, and special education), and in schools (e.g. those serving disadvantaged students), where hiring and retaining teachers are chronic problems" (Dee & Goldhaber, 2017:2). Engelbrecht and Harding (2009:73) as well as McCarthy and Oliphant (2013:3, 5) argue that mathematics is a crucial prerequisite for entering into tertiary education and for careers in the global knowledge based economy and that the 50% unemployment rate of the youth in South Africa is closely linked to the poor quality of mathematical competency. The Mathematics "teacher talent pool" is drained by the private sector offering higher salaries, performance based compensation and more opportunities for promotion.

Fourth, the quality of the mathematics education in schools depends on the quality of the teachers. To be able to fulfil the demand for STEM graduates, the education of children by motivated teachers with content and

pedagogical proficiency in Mathematics is critical. The following key points are made in a CDE (Centre for Development and Enterprise) report (McCarthy, Bernstein & De Villiers, 2011:13): There is a shortage of 15,000 new teachers in South Africa annually, but "[t]he quality of teachers is more important than the extent of the shortage" and more teachers "... will not necessarily improve the performance of learners, especially in scarce subjects such as mathematics and science."

Fifth, schools in remote and disadvantaged areas often do not have access to quality teachers and necessary resources to ensure efficient teaching and learning to take place. The Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) survey found that "... in South Africa teachers with better subject knowledge in mathematics and reading were more commonly deployed to urban and better-resourced schools" (Education For All (EFA), 2015:249).

It is therefore important to investigate the reasons motivate highly qualified mathematics students choose teaching as a career. What will make the career of a specialist in Mathematics more attractive? What are the characteristics, motivations and perceptions of these students to become Mathematics teachers? How can quality Mathematics teachers be retained?

Rationale

It is clear from a survey of the international literature that student achievement is mostly affected by teacher subject knowledge and self-efficacy, which in turn is dependent on academic ability and competency, and the quality of teacher training (Shen, Mansberger & Yang, 2004:227). Satisfaction with one's career depends inter alia on the level of self-efficacy that one experiences because it boosts achievement and a person's happiness and well-being (Allen, 2005:8; Snodgrass, 2010:136). Hofmeyr and Draper assert "targeted quantitative and qualitative research [to be] needed for a proper diagnosis of the problems impeding the effective recruiting, training and retaining of qualitative, competent and committed teachers, and how best to address them" (2015:28).

The Australian Department of Education, Science and Training (2003:60) claims that there is insufficient well-researched knowledge about students' attitudes and motivations concerning the study and teaching of science, technology and mathematics to guide policy. König and Rothland (2012:289) meanwhile state that teacher shortages worldwide led to studies on factors influencing young people to choose teaching as a career, while explaining the high attrition rates.

The shortage of quality qualified teachers in South Africa led to an investigation into the possible factors that influenced the career choice of first year student teachers at the University of Pretoria. These investigations were not subject-specific. Four factors were identified, namely the opportunity for students to realise their full potential, "fringe benefits," financial compensation and "discernable obstacles" (Maree, Hislop-Esterhuizen, Swanepoel & Van der Linde, 2009:39).

Poor matric results in Mathematics and Science in South Africa, as well as poor performance in international numeracy assessments, can be ascribed to the shortage of Mathematics and Science teachers, and the lack of pedagogic skills and knowledge of the subject (McCarthy et al., 2011:10). The poor performance of South African pupils in mathematics in the local 2012 South African Annual National Assessment (ANA), which are internationally benchmarked national tests, the Trends in International Mathematics and Science Study ([TIMSS]; Mullis, Martin, Foy & Arora, 2012), as well as the poor Grade 12 Mathematics results, are indicators of the urgency to find ways to improve the mathematical competency of pupils. The lack of mathematical expertise among teachers in economically disadvantaged schools and in rural areas offers compelling evidence that more mathematics teachers need to be trained.

Hofmeyr and Draper (2015:30) and McCarthy and Oliphant (2013:7, 13) urge that for South Africa to be able to have a knowledge economy and create better jobs, the Government will have to give top priority to the improvement of Mathematics teachers' training. The provision of more teachers without focusing on the quality of their subject and pedagogical knowledge and practical training will not improve the overall standard of education in South Africa. When teaching as a career becomes less attractive, the risk of employing teachers with inadequate qualifications, low self-efficacy and low motivation to innovate is high (EFA, 2015:4).

To be able to fulfil the demand for qualified mathematics teachers by attracting the best candidates, specific recruitment strategies must be developed (Hofmeyr & Draper, 2015:30; Snodgrass, 2010:136). When one knows what factors attracted or influenced students who have already chosen mathematics as their specialising subject at university level, to choose teaching as a career, those strategies can be geared to accomplish the goal to increase the number of high quality, professional and committed mathematics teachers in South Africa.

Student teachers' motivation to choose teaching as a career also correlates with their job satisfaction, which contributes to the retention of these teachers in education (Richardson & Watt, 2010:140). This study makes a contribution to the current literature by identifying the factors that influenced post graduate certificate in education (PGCE) students of Mathematics at three uni-

versities in the Western Cape in South Africa that have chosen teaching as a career.

Conceptual Framework

The Factors Influencing Teaching Choice Scale (FIT-choice scale) was used in the research about mathematics students' motivations to study teaching, since it was developed specifically to determine the factors influencing pupils to choose teaching as a career, and has been used in a number of international studies in the USA, Turkey, Australia, Germany and Norway. The FIT-choice scale is grounded in motivational theory, allowing the measurement and comparison of motivations for different individuals and settings (Watt, Richardson, Klusmann, Kunter, Beyer, Trautwein & Baumert, 2012:791). The development of the FIT-choice scale was based on the Self-Determination Theory (SDT), as well as the Expectancy-Value Theory (EVT) model. The SDT gives insight in the field of motivation by making a distinction between three types of motivation, namely: a-motivation; different levels of extrinsic motivation; and intrinsic motivation, respectively. Intrinsic motivation is seen as the prototype of self-determined activity. The EVT model is a motivational model used to study choice and persistence has been applied in this study pertaining to the factors that influence students to choose Mathematics teaching as a career (expectations and values) and predicting the commitment to pursue the career over a long period of time. Different categories of factors were identified for inclusion in the FIT-choice scale, which was developed to provide an understanding how initial motivations impact teacher recruitment, retention and effectiveness, which is the focus of this study. Self-efficacy, defined as 'the belief in a person's capabilities to achieve a certain goal or result' has relevance in the study of intrinsic motivation. Pajares (1997:45) notes that "researchers have reported that the mathematics self-efficacy of college undergraduates is more predictive of their mathematics interest and choice of math-related courses and majors than either their prior math achievement or math outcome expectations."

Research Methodology and Instruments

The mixed methods approach, which originated in 1959 when Campbell and Fiske used more than one method to study the validity of psychological traits, was used in this study, because the demographics of the respondents as well as their own ideas and experiences, add to and put the information and results in context.

Biographical data were collected, where an open-ended narrative question had to be answered, and a validated questionnaire quantified by a Likert scale was used in this study. The population (N = 45) consisted of all PGCE students in 2015 with mathematics as a subject for their degree, who have decided to pursue teaching as a career at three universities in the Western Cape. Five of the 45 students were not present on the day of the survey. The participants include 16 of the 20 PGCE students from the University of Cape Town (UCT), nine of the ten PGCE students from the University of Stellenbosch (US) and all 15 PGCE students from the University of the Western Cape (UWC). These universities represent the demographics of the Western Cape, and also have cohorts of students from other provinces as well as international students. All three universities offer teacher education degrees.

The demographic data that were collected are gender, age, South African citizen (or not), home town, first and second language, occupation(s) of parents, bursary holder (or not), Mathematics mark for final school examination, year matriculated, highest tertiary qualification, university Mathematics level passed for degree, and preference of geographical area where they want to work.

The three instruments used to obtain data are: a personal details form to collect biographical data, an open ended question and a questionnaire based on the FIT-choice scale with three sections, namely: "motivations about teaching"; "beliefs about teaching (perceptions)"; and "your decision to become a teacher." The FIT-choice scale was developed and validated by Helen M. G. Watt and Paul W. Richardson of Monash University in Melbourne, Australia, in 2006. It was published in 2006 in the *Asia-Pacific Journal of Teacher Education* and technically validated in 2007.

Qualitative data and quantitative data were collected sequentially in order to obtain detailed and comprehensive information about the factors that influence students to choose mathematics teaching as a career. The students completed the open-ended question, first preventing them from influence by the questions in the questionnaire. The purpose of the open-ended question (qualitative data) was to expand the quantitative data collected by means of the questionnaire. The most prevalent factors were identified and interpreted. Demographic data have been collected as "pragmatists agree that research always occurs in social, historical, political, and other contexts" (Creswell, 2003:12). Maree et al. (2009:44) used an eco-systemic approach to investigate the factors that influence the career choice of student teachers by including demographic data in their research. The differences in geographical origin, socio-economic background, culture and gender might influence the factors being investigated and were therefore included in the study.

The questionnaire consists of four parts. Part A is an open ended section where the students have to state their reason(s) for their choice of career. In part B (influential factors) students rate the

importance of their own decision to become a teacher on a seven-point Likert scale from 1 (*not at all important*) to 7 (*extremely important*), with 54 items. Each motivational factor within the FIT instrument is measured by multiple item indicators. The preface to all the motivation items is: "I chose to become a teacher because ..." These motivations include: intrinsic values; personal utility values (job security, time for family, job transferability); social utility values (shape future of children/adolescents, enhance social equity, make social contribution, work with children/adolescents); self-perceptions of individuals' own teaching abilities; the extent to which teaching has been a "fall back" career choice, social influences; and prior positive teaching and learning experiences.

Part C measures the students' beliefs about teaching (perceptions). The participants rate their beliefs about teaching with response options on the same Likert scale of seven possible ratings on 15 items indicating strength of agreement. They indicate whether they perceive teaching as a high in task demand (expert career, high demand) and as a high in task return (social status, salary).

In Part D, participants rate influences on their decision to become a teacher. They have to rate the extent to which they had experienced social dissuasion from teaching as a career choice by answering six questions (See Questionnaire in Appendix A).

The factors influencing the students' career choice were then analysed and thematically categorised. One-way ANOVA's investigating the effect of gender, first language and university on the various factors were done. Student's *t*-tests for pairwise comparisons between the four languages and three universities were performed.

Findings

The Cronbach Alpha coefficient for consistency for the subscales and items in the questionnaire was calculated to determine the reliability of the FIT-choice scale for students from South Africa. The majority of the items have shown a high level of consistency with a coefficient above 0.7. The FIT-choice scale could therefore be used in the South African context (See Table B1 in Appendix B).

Analysis of Influential Factors

The themes that were identified in this analysis are the students' love for and ability to do and teach Mathematics, to make a difference in South Africa ("give back" to the community), make a difference in the lives of children, will have time for family, the influence/motivation of their own teachers and family, job security and teaching as a "back-up plan."

The students perceived (mean Likert score 5.44) that they have the ability to be "a good teacher with good teaching skills." This perception has also been noted in the open-ended questions where students referred to their mathematical skills and the way that they are able to "share their knowledge": "I have always been good at maths," "... in High School because the ability I had to have a better understanding of mathematics, chemistry and physical science, I started to lead an extra class explaining [*sic*] other classmates certain concept [*sic*] and doing preparation of our final examination" and "I believe that I can help Eastern Cape Province to improve the past rate given a chance."

With a mean score of 5.22 for the intrinsic factor of the value of teaching as a career, the students showed that teaching as a career was appealing to them because of the nature of the job itself. Responses were made such as: "I like teaching because I like [*sic*] when you can see in someone's eyes that they understand something they didn't before"; "I want to inspire"; "I always wanted to be a teacher"; "I just love teaching and helping"; "I think it is a meaningful and rewarding career"; "I believe teaching is my calling"; "I prefer to fulfil a supportive role"; "I enjoy helping people"; and "I'm really enjoying it."

The average score for teaching being a "fall-back career," however, was the lowest of all the factor scores (mean of 2.54). This low score corresponds with the literature on factors influencing career choice studies in other countries (Richardson & Watt, 2006:55).

'Personal utility value' is a higher order factor combining "job security," "time for family," and "job transferability." The overall mean score of 4.2 for the higher order factor 'personal utility value' is moderate compared to the other factors' scores. "Job security," "Job transferability," "Time for family" and "Bludging" all had means below 5 with "Bludging" the lowest at 3.53. "Bludging" is a concept mainly used in Australia, which means "evading work" or "choosing an undemanding career." It was also mentioned by the respondents that Mathematics is a scarce-skill subject, and that it should be easy to find employment, and that job opportunities in a greater variety of locations would be possible.

The higher-order factor 'social utility value' had an overall mean score of 5.56. The factors "Shape future of children/adolescents" and "Make social contribution" scored the highest mean values of 5.96 and 5.88, respectively. "Enhance social equity" and "Work with children and adolescents" scored slightly lower, at 5.31 and 5.26 each. The answers to the open-ended question also reflected the importance of these as factors influencing the students' career choice.

Although the mean score for 'prior teaching and learning experiences' was a moderate 5.3, the candid responses of the students show the impact that their teachers had on their choice. Their love of

the subject Mathematics is clear from their discussions.

'Social influences' refer to the influence of others in the students' choice of teaching. The mean score of 3.45 shows that the influence of friends and family was not a major reason for their choice.

Analysis of Beliefs about Teaching

Judging from 'Task demand and task return' being the factor with the highest score of 5.96, it is clear that most of the students believe that teaching is a demanding career requiring expert knowledge. On the other hand, with low scores of 3.51 for "social status," 3.8 for "teacher morale," and 2.73 for "salary" giving an overall mean score of 3.42 for task return, it can be deduced that extrinsic rewards are not believed to be seen as the only compensation for this demanding job.

Analysis of the Decision to Become a Teacher

With a mean score of 5.79 for "satisfaction with choice" the students were quite satisfied with their choice of teaching as a career, even though it was not the first choice for some of them. They did indicate that, probably because of the perception of others that teaching does not pay well, and does not have the professional status it deserves, they had been encouraged by parents and others to choose a different career.

The Effect of Gender, Home Language and University Attended on the Factors

Twenty-two (55%) of the 40 respondents were female. At UCT, half of the respondents were female, 77.8% at US and at UWC the percentage was 46.7 percent (see Table 2). The white Afrikaans-speaking group from the US had the highest percentage of female mathematics student teachers, and the African home language group from UWC the lowest.

Table 1 First languages of the students from three universities in the Western Cape

UNIVERSITY by FIRST LANGUAGE									
UNIV	FIRST LANGUAGE								
	AFR	CREOLE	ENG	FRENCH	ISIXHOSA	ISIZULU	SEPEDI	SETSWANA	TOTAL
UCT	1	1	8	0	3	3	0	0	16
	6.25%	6.25%	50%	0%	18.75%	18.75%	0%	0%	
US	9	0	0	0	0	0	0	0	9
	100%	0%	0%	0%	0%	0%	0%	0%	
UWC	0	0	2	2	9	0	1	1	15
	0%	0%	13.3%	13.3%	60%	0%	6.67%	6.67%	
TOTAL	10	1	10	2	12	3	1	1	40

Both the UCT and the UWC have English as their language of instruction while the US has both Afrikaans and English as their "languages of learning and teaching" (Stellenbosch University, 2014:5). The UCT cohort was culturally and racially more diverse than the US and UWC cohorts (see Table 1).

Table 2 Gender comparisons

	Time for family		Job transferability		Personal utility (higher-order)		Prior experiences	
Gender	Mean	Pr	Mean	Pr	Mean	Pr	Mean	Pr
Female	4.606	0.0259	4.545	0.0425	4.554	0.0148	5.803	0.0105
Male	3.537	< 0.05	3.796	< 0.05	3.757	< 0.05	4.685	< 0.05

From the ANOVA analyses it can be concluded at a significance level of 5% that there is a significant difference in the effect of the influential high order factor 'personal utility' namely "time for family" and "job transferability" as well as the factor "prior experience" on the choice of teaching as a career between males and females. The mean scores for females are higher than that of males on all these aspects. The mean scores for beliefs about teaching and the students' decision to become a teacher are not significantly different between the genders.

Table 3 Home language comparisons

	Intrinsic career value		Fall-back career		Bludging		Work with children/ adolescents		High Demand	
	Mean	Pr	Mean	Pr	Mean	Pr	Mean	Pr	Mean	Pr
African	4.510	0.0059	3.431	0.0038	3.882	0.0030	4.618	0.0428	5.804	0.0445
Afrikaans	5.233	< 0.05	2.067	< 0.05	4.450	< 0.05	5.775	< 0.05	6.633	< 0.05
English	5.867		1.900		2.700		5.750		6.133	
Non-SA	7.000		1.222		1.166		5.500		5.278	

To be able to compare languages home language was categorised as English, Afrikaans, Indigenous South African languages and foreign languages (see Table 3). At a significance level of 5%, differences between the means of the home languages were identified for the factors "intrinsic career value," "fall-back career," "bludging," "work with children/adolescents," and "high demand."

The paired differences have been identified to exist between English first language students and Indigenous African language speakers, foreign language speakers and African speakers as well as between Afrikaans and Foreign language speakers. The African language speakers rated "intrinsic career value" lower than the other three language groups.

"Fall-back career" differences exist between African language speakers and each of the other three languages individually. Although the means of this factor for all four language groups are low, the African language speaking respondents gave a higher rating to this factor than the other three groups.

Perceiving being a teacher an "easy" job as a factor differs significantly between all the languages in pairs except between Afrikaans and African, as well as between English and foreign language speakers. The Afrikaans and African language speaking respondents rated "bludging" significantly higher than the other two groups.

The factor "Working with children/ adolescents" has significantly different means when African language speakers are compared with Afrikaans speakers, and also when African language speakers are compared with English speakers. The Afrikaans and English speakers have similar highest ratings for working with children, with African language speakers rating this factor lowest of the four language groups.

The belief that teaching is a demanding career seen as a "difficult" job differs between African and Afrikaans speakers (who rated this factor the highest), as well as between Afrikaans and Foreign language speakers. The African and Foreign language speakers did not rate "high demand" as high as the Afrikaans speaking group.

Table 4 University comparisons

	High demand		Task demand (higher-order)	
	Mean	Pr	Mean	Pr
UCT	5.729	0.0397	5.600	0.0409
US	6.667	< 0.05	6.444	< 0.05
UWC	6.033		6.043	

The three universities only differ significantly (at a significant level of 5%) with regards to the belief that teaching is a demanding career. The analyses of the comparisons by pairs indicates that UCT and the US differ with regards to high demand, and also with regards to the higher factor "task demand," which is the combination of "expertise" and "high demand." The US students have the largest mean score for "high demand" and "task demand" (see Table 4).

Discussion

Nearly half of the PGCE students with mathematics as a subject in this study were male, half of them were Funza Lusaka bursary holders, most of them wanted to teach in the Western Cape after they qualified, and a quarter of them had changed their original choice of career to teaching and 30% of them had one or more parents that are teachers. The white Afrikaans-speaking students from the US were on average the youngest and had the highest average Grade 12 mathematics mark, while the percentage of males in this group was the lowest.

From the gender comparison, the higher mean score for "time for family" for females reflects the females' traditional role as the primary person to look after and nurture the family. The higher score for "job transferability" for females can be explained by the wife being able to find employment more readily in locations where her husband (the traditional breadwinner) is employed. The influence of the students' mathematics teachers as being inspirational and role models, as well as positive learning experiences at school, were more highly rated by the female than the male participants. Cultural differences, indicated by the different home languages of students in the Western Cape, had an influence on how the factors that motivate students to choose mathematics teaching as a career are rated. The African language speakers valued their interest in and love for teaching at a lower level than did the other groups while they have allocated a slightly higher score to teaching as a career to "fall back on." They also did not rate working with children as important a factor in their choice of career as the other groups. The Afrikaans speaking students from the US perceived teaching as a more demanding career when compared to students from the other universities in this study.

The job security of teaching as a profession, the mobility in terms of where they can work, and the perception that they will have more leisure time and more time for family, were less important factors in career choices of the group as a whole. They rated the factor that teaching is a "fall back" career the lowest. The students also indicated remuneration, the status of teaching, and teacher morale, as the least important motivations.

The current state of education in South Africa may contribute negatively towards teaching as a career, but can also motivate young people to pursue teaching as a career, because they want to make a difference. Forty percent of the students indicated that they want to make a difference in

South Africa contributing to improve education in the country by motivating pupils, be part of transforming the country by creating more opportunities for non-white qualified individuals, "give back" to the community, answer to a calling to serve in areas where there is a shortage of Mathematics teachers, and share knowledge amongst disadvantaged children. Half of the respondents believe that they could influence and develop young minds to take the nation forward, encourage them to do their best by developing their potential and impart their own "love of mathematics." These results correspond with the findings in the literature, where social utility values include those major factors influencing young people to choose teaching as a career overall (Watt et al., 2012:792).

Conclusion

The factors that have the largest influence on students of mathematics to choose teaching as a career are intrinsically motivated. The opportunity to make a difference in the lives of children, the community and the country are highly rated. The students are satisfied with their choice of career and believe that they have the knowledge and ability to be good teachers while they admit Mathematics teaching to be a demanding career. They acknowledge the mostly positive impact of their mathematics teachers, as well as their own experiences at school, in their decision to become mathematics teachers.

Studying the motivations, expectancies, values and career choice satisfaction of pre-service teachers in South Africa makes it possible to assist in the development of processes for the recruitment of teachers by linking the motivations to teacher types. Beginner teachers will feel more efficacious, satisfied with their choice, and not experience burnout if their expectations are fulfilled (Watt et al., 2012:800–801). Hofmeyr and Draper (2015:7, 26) question the fact that pupils in South Africa are accepted to study teaching "without any reference to what motivates them to become teachers."

Identifying the factors and values that influence Mathematics students to become teachers will broaden the knowledge base of what motivates young mathematicians to choose teaching as a career, to assist roleplayers in managing the following:

Firstly, in order to determine ways to attract more mathematically competent pupils to choose teaching as a career, more effective recruitment strategies can be developed by defining the target group more specifically and accurately.

Secondly, the characteristics of people choosing mathematics teaching will provide valuable information to policymakers and change agents, for strategic education planning in a society where there is an increase in the demand for STEM graduates in other fields.

Thirdly, recruitment of mathematics teachers from other careers by identifying the occupations from which students "switch" to teaching as a career, can be pursued.

Fourthly, these findings can also be utilised by career counsellors and educators when they advise pupils about their future studies (Chatterjee, 2013:196–197; Hall, Dickerson, Batts, Kauffmann & Bosse, 2011:32).

Fifthly, when the motivations of students are determined, the selection of students to study teaching can be based on those factors that correlate with dedication to teaching in order to ensure long term commitment.

Lastly, the retention of teachers depends *inter alia* on whether the initial perceptions and motivations of beginner teachers are realised. A question that arises due to the difference in the ratings of task demand (high) and task return (low) is whether their intrinsic motivation would be sufficient to make up for the low social status, low salary, as well as a lack of professional advancement opportunities identified in the survey. The Cognitive Evaluation Theory (CET), a sub-theory of SDT, which focuses on the needs for competence and autonomy specifies that "feelings of competence will not enhance intrinsic motivation unless accompanied by a sense of autonomy" (Ryan & Deci, 2000:70). Intrinsic motivation is sustained and enhanced by supportive actions. The sustainability of intrinsic motivation is thus more important than the cause thereof. It was found that "optimal challenges, effectance-promoting feedback, and freedom from demeaning evaluations [...] facilitate intrinsic motivation." It was also confirmed that "... not only tangible rewards but also threats, deadlines, directives, pressured evaluations and imposed goals diminish intrinsic motivation." On the other hand, intrinsic motivation is boosted by "... choice, acknowledgement of feelings, and opportunities for self-direction," because it gives people a bigger feeling of autonomy (Ryan & Deci, 2000:70). The mentoring of newly qualified teachers is a prominent priority in countries with the highest Programme for International Student Assessment (PISA) and TIMSS scores. In New Zealand, first year teachers have an 80% workload, and second year teachers a 90% work load. The extra time is allocated to coaching, observation of experienced teachers, taking part in professional development programmes, and getting to know the curriculum. High performing countries in East Asia apply similar models to mentor their beginner teachers (Darling-Hammond, 2013:48). The European Commission notes that "therefore, the beginning teacher should be allocated fewer teaching hours, to

allow more time for lesson preparation, induction activities and meetings with mentors, who will also need time off teaching duties to perform their role effectively" (2012:35). It is thus essential for all role players to ensure that especially beginner teachers are not disillusioned because their intrinsic reasons for choosing teaching as a career have been negated by other factors that overwhelm them.

In South Africa, the transformation of education has been burdened by political, social and practical issues. If a country does not have competent teachers and well-resourced schools, professional autonomy opposed to administrative and bureaucratic control, will not be feasible. All roleplayers should have consensus on the required subject knowledge and skills of teachers and learners necessary for the 21st century before authority and autonomy can be devolved to the classroom teacher level. It is therefore vital to reform education so that recruited high-quality teachers are not frustrated by a perceived inefficient Initial Teacher Education (ITE), poor conditions at schools, overcrowded classrooms, the absence of professional development opportunities and promotion, and a lack of support. They may then decide to switch to a different profession (OECD, 2010:5).

> *These are daunting challenges and thus devising effective education policies will become ever more difficult, as schools need to prepare students to deal with more rapid change than ever before, for jobs that have not yet been created, to use technologies that have not yet been invented and to solve economic and social challenges that we do not yet know will arise. But those school systems that do well today, as well as those that have shown rapid improvement, demonstrate that it can be done* (OECD, 2010:5).

Limitations

The research was restricted to three universities in the Western Cape, one of nine provinces in South Africa. Although the sample used is heterogeneous in its composition, the proportions of different language and race groups in the sample are not representative of the country as a whole. The study can be extended to the other provinces in South Africa to investigate why students with Mathematics as a major subject choose teaching as a career. More in depth, qualitative interviews with these student teachers will add to the knowledge base for making the right decisions when recruiting and selecting students that will be committed to teaching as a career.

Acknowledgements

This study was done under the supervision of Professor Jonathan Jansen, in fulfilment of the requirements of a Master of Education (school change). The author wishes to thank Professor Jansen for his support, Professor Robert Schall for his guidance with the statistical analyses, as well as Helen Watt and Paul Richardson for their permission to use the FIT-Choice scale questionnaire.

Notes

i. There are currently 23 universities and universities of technology offering teaching programmes in South Africa with the recent opening of two universities in Mpumalanga Province and the Northern Cape Province. One of the universities, the University of South Africa (UNISA), is a distance learning institution while the others are contact universities and universities of technology.
ii. Published under a Creative Commons Attribution Licence.

References

Allen MB 2005. *Eight questions on teacher recruitment and retention: What does the research say?* Denver, CO: Education Commission of the States (ECS). Available at https://files.eric.ed.gov/fulltext/ED489332.pdf. Accessed 16 February 2018.

Australian Department of Education, Science and Training 2003. *Australia's teachers: Australia's future: Advancing innovation, science, technology and mathematics* (Main report). Canberra, Australia: Commonwealth of Australia. Available at http://www.voced.edu.au/content/ngv:20501. Accessed 16 February 2018.

Chatterjee S 2013. A conceptual framework examining the antecedents of career decisiveness using motivation systems theory. *Turkish Online Journal of Distance Education*, 14(4):196–209. Available at http://dergipark.ulakbim.gov.tr/tojde/article/view/5000102264. Accessed 16 February 2018.

Creswell JW 2003. *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed). Thousand Oaks, CA: Sage.

Darling-Hammond L 2013. *Developing and sustaining a high-quality teaching force* (Prepared for the Global Cities Education Network). New York, NY: Asia Society. Available at https://edpolicy.stanford.edu/sites/default/files/publications/developing-and-sustaining-high-quality-teacher-force.pdf. Accessed 20 March 2018.

Dee TS & Goldhaber D 2017. *Understanding and addressing teacher shortages in the United States* (Policy Proposal 2017-05). Washington, DC: The Hamilton Project. Available at http://www.hamiltonproject.org/assets/files/understanding_and_addressing_teacher_shortages_in_us_pp.pdf. Accessed 16 February 2018.

Education For All (EFA) Global Monitoring Report team 2015. *Investing in teachers is investing in learning: A prerequisite for the transformative power of education* (Background paper for the Oslo Summit on Education for Development 6–7 July 2015). Available at http://unesdoc.unesco.org/images/0023/002338/233897E.pdf. Accessed 27 February 2018.

Engelbrecht J & Harding A 2009. New numbers in mathematics in South Africa. *International Journal of Mathematical Education in Science and Technology*, 40(1):73–86. https://doi.org/10.1080/00207390802597738

European Commission 2012. *Supporting the teaching professions for better learning outcomes* (Commission staff working document). Strasbourg, France: Author. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2012:0374:FIN:EN:PDF. Accessed 27 February 2018.

Hall C, Dickerson J, Batts D, Kauffmann P & Bosse M 2011. Are we missing opportunities to encourage interest in STEM fields? *Journal of Technology Education*, 23(1):32–46. https://doi.org/10.21061/jte.v23i1.a.4

Hofmeyr J & Draper K 2015. *Teachers in South Africa: Supply and demand 2013–2025*. Johannesburg, South Africa: The Centre for Development and Enterprise. Available at http://www.cde.org.za/wp-content/uploads/2015/03/Final-Revised-ES-TeacherSupplyandDemand2025.pdf. Accessed 13 March 2018.

Ingersoll RM & May H 2010. *The magnitude, destinations, and determinants of Mathematics and Science teacher turnover* (Consortium for Policy Research in Education Research Report # RR-66). Available at http://www.cpre.org/sites/default/files/researchreport/833_math-and-science-teacher-turnoveringersoll-and-may-2010final-web-ready.pdf. Accessed 20 March 2018.

Kennedy TJ & Odell MRL 2014. Engaging students in STEM Education. *Science Education International*, 25(3):246–258. Available at https://files.eric.ed.gov/fulltext/EJ1044508.pdf. Accessed 13 February 2018.

König J & Rothland M 2012. Motivations for choosing teaching as a career: Effects on general pedagogical knowledge during initial teacher education. *Asia-Pacific Journal of Teacher Education*, 40(3):289–315. https://doi.org/10.1080/1359866X.2012.700045

Maree JG, Hislop-Esterhuizen N, Swanepoel A & Van der Linde MJ 2009. Factors affecting the career choice of first-year student teachers. *International Journal of Adolescence and Youth*, 15(1–2):39–79. https://doi.org/10.1080/02673843.2009.9748020

McCarthy J, Bernstein A & De Villiers R (eds.) 2011. Value in the classroom: The quantity and quality of South Africa's teachers. *CDE In Depth*, 11. Johannesburg, South Africa: Centre for Development and Enterprise (CDE). Available at http://www.cde.org.za/wp-content/uploads/2012/12/VALUE_IN_THE_CLASSROOM_full_report.pdf. Accessed 8 July 2013.

McCarthy J & Oliphant R 2013. *Mathematics outcomes in South African schools. What are the facts? What should be done?* Johannesburg, South Africa: The Centre for Development and Enterprise (CDE). Available at https://www.cde.org.za/wp-content/uploads/2013/10/MATHEMATICS%20OUTCOMES%20IN%20SOUTH%20AFRICAN%20SCHOOLS.pdf. Accessed 27 February 2018.

Mullis IVS, Martin MO, Foy P & Arora A 2012. *TIMSS 2011: International results in Mathematics*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Newton XA, Jang H, Nunes N & Stone E 2010. Recruiting, preparing, and retaining high quality secondary Mathematics and Science teachers for urban schools: The Cal Teach Experimental Program. *Issues in Teacher Education*, 19(1):21–40. Available at https://files.eric.ed.gov/fulltext/EJ887293.pdf. Accessed 8 February 2018.

OECD 2010. *PISA 2009 results: What makes a school successful? – Resources, policies and practices* (Vol. IV). Paris, France: Author. https://doi.org/10.1787/9789264091559-en

Pajares F 1997. Current direction in self-efficacy research. In ML Maehr & PR Pintrich (eds). *Advances in motivation and achievement* (Vol. 10). Greenwich, CT: JAI Press.

Richardson PW & Watt HMG 2006. Who chooses teaching and why? Profiling characteristics and motivations across three Australian universities. *Asia-Pacific Journal of Teacher Education*, 34(1):27–56. https://doi.org/10.1080/13598660500480290

Richardson PW & Watt HMG 2010. Current and future directions in teacher motivation research. In TC Urdan & SA Karabenick (eds). *The decade ahead: Applications and contexts of motivation and achievement*. Bingley, England: Emerald Group Publishing Limited.

Ryan RM & Deci EL 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1):68–78. https://doi.org/10.1037/0003-066X.55.1.68

Shen J, Mansberger NB & Yang H 2004. Teacher quality and students placed at risk: Results from the Baccalaureate and beyond longitudinal study, 1993-97. *Educational Horizons*, 82(3):226–235.

Snodgrass H 2010. Perspectives of high-achieving women on teaching. *The New Educator*, 6(2):135–152. https://doi.org/10.1080/1547688X.2010.10399594

Stellenbosch University 2014. *Language policy of Stellenbosch University*. Available at https://www.sun.ac.za/english/Documents/Language/Language%20Policy%202014%20Final%2012%20Dec%202014.pdf. Accessed 18 March 2018.

Van Broekhuizen H 2015. *Teacher supply in South Africa: A focus on initial teacher education graduate production*. Stellenbosch Economic Working Papers: WP07/15. Stellenbosch, South Africa: Department of Economics and the Bureau for Economic Research at the University of Stellenbosch. Available at https://www.ekon.sun.ac.za/wpapers/2015/wp072015. Accessed 13 March 2018.

Watt HMG, Richardson PW, Klusmann U, Kunter M, Beyer B, Trautwein U & Baumert J 2012. Motivations for choosing teaching as a career: An international comparison using the FIT-Choice scale. *Teaching and Teacher Education*, 28(6):791–805. https://doi.org/10.1016/j.tate.2012.03.003

Watt HMG, Richardson PW & Pietch JR 2009. Choosing to teach in the "STEM" disciplines: Characteristics and motivations of science, technology, and mathematics teachers from Australia and the United States. In A Selkirk & M Tichenor (eds). *Teacher education policy, practice and research*. New York, NY: Nova Science.

Wolmarans N, Smit R, Collier-Reed B & Leather H 2010. *Addressing concerns with the NSC: An analysis of first-year student performance in Mathematics and Physics*. Paper presented at the 18th Conference of the Southern African Association for Research in Mathematics, Science and Technology Education, Durban, 18–21 January. Available at http://www.mecheng.uct.ac.za/usr/mecheng/staff/academic/brandon/Wolmarans2010Addressing.pdf. Accessed 13 March 2018.

Appendix A

Questionnaire

Part A

Please briefly state your main reason(s) for choosing to become a teacher:

Part B – Influential factors

For each statement below, please rate how important it as in **YOUR** decision to become a teacher, from **1** (not at all important in your decision) to **7** (extremely important in your decision).

Please type an **X** in the block of the number that best describes the importance of each.

"I chose to become a teacher because ..."

		Not at all important						Extremely important
		1	2	3	4	5	6	7
B1	I am interested in teaching							
B2	Part–time teaching could allow me more family time							
B3	My friends think I should become a teacher							
B4	As a teacher I will have lengthy holidays							
B5	I have the qualities of a good teacher							
B6	Teaching allows me to provide a service to society							
B7	I have always wanted to be a teacher							
B8	Teaching will be a useful job for me when travelling							
B9	Teaching will allow me to shape child/adolescent values							
B10	I want to help children/adolescents learn							
B11	I was unsure of what career I wanted							
B12	I like teaching							
B13	I want a job that involves working with children/adolescents							
B14	Teaching will offer a steady career path							
B16	Teaching hours will fit with the responsibilities of having a family							
B17	I have had inspirational teachers							
B18	As a teacher I will have a short working day							
B19	I have good teaching skills							
B20	Teachers make a worthwhile social contribution							
B22	A teaching qualification recognised everywhere							
B23	Teaching will allow me to influence the next generation							
B24	My family think I should become a teacher							
B26	I want to work in a child/adolescent-centred environment							
B27	Teaching will provide a reliable income							
B29	School holidays will fit in with family commitments							
B30	I have had good teachers as role-models							
B31	Teaching enables me to 'give back' to society							
B35	I was not accepted into my first-choice career							
B36	Teaching will allow me to raise the ambitions of underprivileged youth							
B37	I like working with children/adolescents							
B38	Teaching will be a secure job							
B39	I have had positive learning experiences							
B40	People I've worked with think I should become a teacher							
B43	Teaching is a career suited to my abilities							
B45	A teaching job will allow me to choose where I wish to live							
B48	I chose teaching as a last-resort career							
B49	Teaching will allow me to benefit the socially disadvantaged							
*B52	Teaching is a fulfilling career							
*B53	Teaching will allow me to have an impact on children/adolescents							
*B54	Teaching will allow me to work against social disadvantage							

Part C – Beliefs about teaching

For each question below, please rate the extent to which **YOU** agree it is true about teaching, from **1** (not at all) to **7** (extremely).

Please type an **X** in the block of the number that best describes your agreement for each.

		Not at all						Extremely
		1	2	3	4	5	6	7
C1	Do you believe teaching is well paid?							
C2	Do you think teachers have a heavy workload?							
C3	Do you think teachers earn a good salary?							
C4	Do you believe teachers are perceived as professionals?							
C5	Do you think teachers have high morale?							
C6	Do you think teaching is a highly skilled occupation?							
C7	Do you think teaching is emotionally demanding?							
C8	Do you believe teaching is perceived as a high-status occupation?							
C9	Do you think teachers feel valued by society?							
C10	Do you think teaching requires high levels of expert knowledge?							
C11	Do you think teaching is hard work?							
C12	Do you believe teaching is a well-respected career?							
C13	Do you think teachers feel their occupations has high social status?							
C14	Do you think teachers need high levels of technical knowledge?							
C15	Do you think teachers need highly specialised knowledge?							

Part D – Your decision to become a teacher

For each question below, please rate the extent to which it is true for **YOU**, from **1** (not at all) to **7** (extremely).

Please type an **X** in the block of the number that best describes your agreement for each.

		Not at all						Extremely
		1	2	3	4	5	6	7
D1	How carefully have you thought about becoming a teacher?							
D2	Were you encouraged to pursue careers other than teaching?							
D3	How satisfied are you with your choice of becoming a teacher?							
D4	Did others tell you teaching was not a good career choice?							
D5	How happy are you with your decision to become a teacher?							
D6	Did others influence you to consider careers other than teaching?							

Appendix B: Final Empirically Validated "FIT-Choice" Subscales and Items
Part A: Open-Ended Question

Part B: Influential Factors

Higher-order factor	Factor	Item #	Anchors: 1 (not at all), to 7 (extremely)
			Item stem: ''I chose to become a teacher because …''
N/A	Ability	B5	I have the qualities of a good teacher
		B19	I have good teaching skills
		B43	Teaching is a career suited to my abilities
N/A	Intrinsic career value	B1	I am interested in teaching
		B7	I've always wanted to be a teacher
		B12	I like teaching
N/A	Fall-back career	B11	I was unsure of what career I wanted
		B35	I was not accepted into my first-choice career
		B48	I chose teaching as a last-resort career
Personal utility value	Job security	B14	Teaching will offer a steady career path
		B27	Teaching will provide a reliable income
		B38	Teaching will be a secure job
	Time for family	B2	Part time teaching could allow more family time
		B16	Teaching hours will fit with the responsibilities of having a family
		B29	School holidays will fit in with family commitments
		B4	As a teacher I will have lengthy holidays
		B18	As a teacher I will have a short working day
	Job transferability	B8	Teaching will be a useful job for me to have when travelling
		B22	A teaching qualification is recognised everywhere
		B45	A teaching job will allow me to choose where I wish to live
Social utility value	Shape future of children/ adolescents	B9	Teaching will allow me to shape child/adolescent values
		B23	Teaching will allow me to influence the next generation
		B53	Teaching will allow me to have an impact on children/ adolescents
	Enhance social equity	B49	Teaching will allow me to benefit the socially disadvantaged
		B54	Teaching will allow me to work against social disadvantage
		B36	Teaching will allow me to raise the ambitions of underprivileged youth
	Make social contribution	B6	Teaching allows me to provide a service to society
		B20	Teachers make a worthwhile social contribution
		B31	Teaching enables me to 'give back' to society
	Work with children/ adolescents	B10	I want to help children/adolescents learn
		B13	I want a job that involves working with children/adolescents
		B26	I want to work in a child/adolescent-centred environment
		B37	I like working with children/adolescents
N/A	Prior teaching and learning experiences	B17	I have had inspirational teachers
		B30	I have had good teachers as role-models
		B39	I have had positive learning experiences
N/A	Social influences	B3	My friends think I should become a teacher
		B24	My family think I should become a teacher
		B40	People I've worked with think I should become a teacher

Part C: Beliefs About Teaching

Higher-order factor	Factor	Item #	Anchors: 1 (not at all), to 7 (extremely)
Task demand	Expertise	C10	Do you think teaching requires high levels of expert knowledge?
		C14	Do you think teachers need high levels of technical knowledge?
		C15	Do you think teachers need highly specialised knowledge?
	Difficulty	C2	Do you think teachers have a heavy workload?
		C7	Do you think teaching is emotionally demanding?
		C11	Do you think teaching is hard work?
Task return	Social status	C4	Do you believe teachers are perceived as professionals?
		C8	Do you believe teaching is perceived as a high-status occupation?
		C12	Do you believe teaching is a well-respected career?
		C5	Do you think teachers have high morale?
		C9	Do you think teachers feel valued by society?
		C13	Do you think teachers feel their occupation has high social status?
	Salary	C1	Do you think teaching is well paid?
		C3	Do you think teachers earn a good salary?

Part D: Your Decision to Become a Teacher

Higher-order factor	Factor	Item #	Anchors: 1 (not at all), to 7 (extremely)
N/A	Social dissuasion	D2	Were you encouraged to pursue careers other than teaching?
		D4	Did others tell you teaching was not a good career choice?
		D6	Did others influence you to consider careers other than teaching?
N/A	Satisfaction with choice	D1	How carefully have you thought about becoming a teacher?
		D3	How satisfied are you with your choice of becoming a teacher?
		D5	How happy are you with your decision to become a teacher?

Helen Watt, School of Education, University of Michigan, 610 East University #4204D, Ann Arbor MI 48109-1259 USA. Tel: (+1 734) 647-1082, Fax: (+1 734) 936-1606, Email: hwatt@umich.edu. Paul Richardson, Faculty of Education, Monash University, Clayton Campus, Melbourne VIC 3800, Australia. Tel: (+61 3) 9905-2771, Fax: (+61 3) 9905-5400, Email: paul.richardson@education.monash.edu.au