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Pre-service teachers' perceptions of their parents' and teachers' attitudes towards mathematics

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Mathematics is integral to the successful study of accounting. The purpose of the study was to determine accounting students' perceptions of attitudes towards mathematics among their parents and teachers. The setting for this study is a higher education institution (HEI) in KwaZulu-Natal, South Africa. This study included a convenience sample (quantitative) of 255 pre-service accounting teachers from an HEI in South Africa, and a purposive sample (qualitative) of 18 students. Data collection was through the Fennema–Sherman Mathematics mother's, father's and teacher's attitude scales, and an interview schedule designed by the researcher. A sequential explanatory design and sampling were employed. Data were analysed using SPSS for quantitative data, transcribed and analysed qualitatively for interviews. The study revealed that the Fennema–Sherman Mathematics mother's, father's and teacher's attitude scales scores are strongly positive towards mathematics. The out-of-home influences, namely, teachers and friends, were ranked higher than home influences, for example, mother, father and siblings. There are different degrees of support from the home. More students 'strongly agreed' that the support came from school, specifically from teachers and peers and friends. Teachers and friends as a result occupy a key role in developing positive attitudes towards mathematics. In the South African context, teachers and friends and peers occupy a more significant role in developing positive attitudes towards mathematics than do parents and siblings. Should the instrument be used again, it would be appropriate for the South African environment to deliberate on support from family members, rather than simply from mother and father.

Keywords: mathematics; parents' attitude to mathematics; teacher's attitude to mathematics; pre-service teachers; attitudes towards mathematics.

Introduction

Mathematics is integral to the successful study of accounting. Pre-service teachers perform a variety of calculations in an accounting course, including General Education and Training (GET) Mathematics (Grades R-9), such as place–value numerical system, basic arithmetic operations and integers, fractions, percentages, decimals, ratios, rates, proportions, formulas, linear algebraic equations, mathematical modelling and Further Education and Training (FET) Mathematics (Grade 10–12), such as data handling and probability, for example, average and weighted average price, forecasting and projections in cash budgets, and projected income statements (Babalola & Abiola 2013; Mkhize 2019; Mostyn 2008a, 2008b). Pre-service teachers are awarded for showing detailed workings and cross-referencing it to the amount recorded in subsidiary journals/ledgers and financial statements as well as written in theory or application answers. In the accounting class, pre-service teachers are expected to have mathematical knowledge and problem-solving abilities. The American Accounting Association (Scott 1941) defined accounting as a 'process of identifying, measuring, analysing and communicating economic information to permit informed judgements and decision-making by users of the information' (Maheshwari, Maheshwari & Maheshwari 2013), and The American Accounting Association (1966) defined accounting as (Banerjee 2008):

> [*T*]he art of recording, classifying, and summarizing in a significant manner and in terms of money, transaction and events which are, in part at least of financial character, and interpreting the results thereof (p. 1).

Mathematics is defined as an 'area of investigation which logically analyses ordering, operational, and structural relationships' (Gilfeather & DelRegato 1999:2). The majority of accounting definitions assert that accounting requires numerical and analytical skills, which are also integral elements of mathematics (Shaftel & Shaftel 2005). A major factor that might impact on a student's attitude towards accounting is his or her attitude towards mathematics (Joyce & Hassall 2006).

Attitude is defined as a learnt predisposition or tendency on the part of an individual to respond positively/favourably or negatively/unfavourably to a certain object, person or idea/situation (Aiken 1970; Ajzen & Fishbein 2000; Haladyna, Shaughnessy, & Shaughnessy 1983; McLeod 1992). The term 'attitude' is borrowed from social psychology and has the colloquial connotations from everyday speech expressive of feelings, emotions, behaviour, etc. (Abbas 2011). The attitudes are influenced by parents, friends, teachers and other models (Fennema & Sherman 1976; Jazdzewski 2011:7). The purpose of the study was to determine accounting students' perceptions of their parents' and teachers' attitudes towards mathematics. The research questions in the study were formulated as follows: what are students' perceptions of their parents' and teachers' attitudes towards mathematics? What is the relationship between parents' and teachers' attitudes towards mathematics and students' demographic variables?

Literature review

Attitudes towards mathematics

Neale (1969) defined attitude as:

> [*A*] liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless. (p. 632)

Teacher's attitude and beliefs, teaching style and behaviour, parents' attitudes and beliefs affect the student's attitude towards mathematics. The attitudes of parents and children towards mathematics play an important role in children's achievement in mathematics (Soni & Kumari 2015). The widely used Fennema–Sherman Mathematics Attitude Scale (Fennema & Sherman 1976) that focusses on student perception of mother's, father's and teacher's interest in mathematics was used because attitudes are influenced by parents, friends, teachers and other role models.

The attitude of parents towards mathematics

Parental encouragement has been found to strongly influence children's attitudes towards mathematics (Köğce et al. 2009; Scarpello 2005). Hurst (2012:98) explored the effect of student attitudes and beliefs on mathematics education and found that the majority of students mentioned the teacher and almost half of the students mentioned family members as having greatly influenced their interest in mathematics. Fathers were mentioned much more often than any other family members. Dweck and Leggett (1988) discovered that parents play a significant role in shaping the way students view their mathematical ability and their related performance. For example, if parents believe that mathematics ability is genetic and success reflects genetic predisposition, then students who receive such messages encounter difficulty, viewing those challenges as proof of the fact that they lack natural mathematics ability.

In addition, Scarpello (2005) stated that parental support in mathematics significantly influences students' learning experiences and attitude towards mathematics. Students with higher grades in mathematics perceived that their parents were affirming their effort in mathematics. Students' belief in their ability to succeed in a career may also be improved through strong parental encouragement, support and affirmation of the student's career selection. Supporting this view, a study by Aruwa (2011), which investigated some of the influences that impinge on students' attitudes towards mathematics, found that the exposure of participants to mathematical experiences at a young age by parents appeared to have assisted them in mathematics during the last years of primary school and through to secondary school. The value parents attached on mathematics, continued support for their children's achievement and having realistic expectations of their children contributed a great deal in assisting participants to strive for mathematical excellence. According to Naidoo (2011) and Stuart (2000), peers and friends influence adolescent career choice and may have a positive or negative influence on students' attitudes towards mathematics. Falbo, Lein and Amador (2001) suggested that the influence of peers and friends is more significant than the influence of parents. In Ontario, Canada, a family mathematics programme has helped to promote a positive attitude towards mathematics in both parents and their children. The aim of this programme was to encourage parental involvement in their children's mathematics education. Parents worked with their children doing mathematics, and observations of the family mathematics programme evenings indicated that (Onslow 1992):

> [*T*]he parents and their children were less anxious as they become comfortable experimenting with ideas and as they realised that they did not have to know the current answer or rule immediately, that guessing and checking was a legitimate aspect of mathematics. (p. 29)

A majority of parents' comments reported that understanding 'why' had made the learning more meaningful and enjoyable for them. Family positivity towards mathematics would narrow the gap between learners who are able to understand mathematics and those who struggle with new concepts. Family attitude towards mathematics might widen the gap as parents of disadvantaged children tended to stay away.

Lastly, a study by Frazier-Kouassi (1999) found a significant difference between urban students (m = 29.19) and rural students (m = 34.14) on the mother's mathematics attitude subscale. Rural students, on average, agreed more strongly with the statement that mothers support and affirm their efforts in mathematics than urban students (t = −2.39; p = 0.018). Rural mothers perceived the value of education as more important than urban mothers; hence, the former were more likely to encourage, support and affirm their children's efforts in mathematics.

Teacher's attitude towards mathematics

Jadwiga (2009), who examined 11 autobiographies of pre-service teachers and seven records of college algebra students to determine mathematics teachers' influence on students' attitudes, found that teachers' behaviour patterns in

mathematics classrooms had a significant impact on students' attitudes towards mathematics. The author identified two types of mathematics teachers: (1) Mathematics teachers who have students who understand and like mathematics, have fun and interesting lessons, have students actively engaged in the lesson and explain to the students the importance of learning mathematics and how it is related to their lives. These successful mathematics teachers are enthusiastic about teaching mathematics and genuinely care about their students and learning of mathematics and (2) Mathematics teachers who influence students' attitude towards mathematics in a negative way, have boring and monotonous mathematics lessons in which students are not actively involved; teachers who do not communicate the importance and relevance of mathematics to students lives. These teachers do not go out of their way to assist their students with mathematics. They teach at a rapid pace, do not encourage questions and are unavailable to provide help outside the classroom.

Mensah, Okyere and Kuranchie (2013), investigating the influence of teacher attitude on student attitude, found a significant relationship between teacher attitude and student attitude towards mathematics, and that a positive attitude on the part of the teachers generated confidence in students. Consequently, students developed a positive attitude towards the learning of mathematics. The teacher's attitude was mirrored in the attitude of his or her students towards the subject. When teachers created an interesting and non-threatening environment in their mathematics classrooms, and modelled enthusiasm for the teaching and learning of mathematics, the students imitated the teachers' behaviour and developed a positive attitude towards mathematics and learnt it without inhibition. Similarly, Daniels and Arapostathis (2005) suggested that the positive teacher–student relationship positively affects student motivation and work ethic, enhances students' interest in mathematics learning and engenders student engagement in mathematics. Similarly, a study by Odiri (2011), on the influence of teachers' attitude on students' learning of mathematics in Nigerian secondary schools, confirmed that students draw from their teachers' disposition to form their own attitudes, which eventually influence their learning outcomes. The attitude of teachers towards their students must be positive so as to carry them along. The study suggested that seminars and workshops for teachers on having a positive disposition when teaching should be given serious consideration by education stakeholders.

Choudhury and Das (2012) found a significant connection between attitude towards mathematics and achievement. Whereas Vandecandelaere et al. (2012) found no direct link between learning environment and student attitudes towards mathematics, Fast et al. (2010) found that students who perceived their learning environments as more caring, challenging and mastery-oriented had significantly higher levels of mathematics self-efficacy than those in less caring, less challenging and less mastery-oriented learning environments. Fast et al. also found that higher levels of mathematics efficacy positively affected students' mathematics performance, and they suggested that while student perceptions of the classroom environment do not directly impact mathematics performance on standardised tests, they do impact mathematics performance indirectly via the mediating, albeit small, effect of mathematics efficacy.

Aruwa (2011) claimed that teachers' personal characteristics and the way they related to their students appeared to have influenced the way participants related to mathematics. Both teachers' pedagogical practices and the expectations they had of students regarding their achievement appeared to have influenced students' achievement orientations. Goldhaber (2002) found similarly that students' performance depended on teacher characteristics, such as inspiring students, being approachable and showing enthusiasm. Among the findings in a study by Naidoo (2011) of mathematical attitudes and achievement strategies of successful mathematics learners were that teachers occupy an important role in shaping learners' attitudes towards mathematics, that learners are anxious when asked to solve mathematical problems, that parents are encouraging of their children learning mathematics, that the importance of mathematics for future careers exerted a significant effect on mathematical achievement and that strategies employed by learners, which impact positively on their achievement in mathematics, include mastery experience, motivation, private tuition and peer group teaching–learning.

Ashton and Webb (1986) distinguished between low self-efficacy teachers and high self-efficacy teachers: a teacher with a low self-efficacy, who relies on authority that comes by virtue of his or her position as the leader of the class, tends to be distrustful of students and feels threatened when the roles of teacher and student are blurred, whereas a teacher with a high self-efficacy, who relies on an earned sense of authority, will make the students the centre of the learning environment, will treat them with respect and will provide appropriate tasks that will enhance their learning.

Social cognitive and self-efficacy theories

Social cognitive theory highlights the idea that much human learning occurs in a social environment through observing others, whereby people acquire knowledge of rules, skills, strategies, beliefs and attitudes (Bandura 1986). Environmental factors also affect students' behaviour: for example, modelling and persuasion by family members, friends and teachers. Self-Efficacy is an individual's belief in his or her capacity to execute behaviours necessary to produce specific performance attainments. Social cognitive theory outlines four sources of information from which efficacy expectations are learnt and which individuals use to judge their efficacy (Bandura 1977, 1986, 1997). The Bandura's sources of efficacy beliefs are as follows:

- Outcome/mastery experiences – student's own past experiences influence the ability to perform a task
- Vicarious experiences/modelling – students observe the performances of others. Prior successes can elevate efficacy and poor failures can lower efficacy

- Verbal persuasion – positive persuasions encourage and empower. Negative persuasion weakens self-efficacy
- Emotional arousal/physiological states – having strong emotions like anger and fear. Repeated practice reduces emotional arousal.

Methodology

The following methods were adopted in conducting this study.

Research design and sampling

A pragmatic, sequential, explanatory mixed-methods research design and sampling were adopted for this study, and it included a sequential collection of both quantitative and qualitative data to provide answers to the research questions. Quantitative research attempts the precise measurement of behaviour, knowledge, opinions or attitudes (Cooper & Schindler 2008), while qualitative research methods produce a wealth of detailed information, thereby increasing the depth of understanding and reducing generalisability (Patton 2002). For the first phase - quantitative, the researcher used convenience sampling. The pre-service accounting teachers are easy to reach and contact as they are based at a higher education institution (HEI). The quantitative sample size consisted of 255 pre-service accounting teachers (143 first-, 77 second- and 35 third-year of study). For the second phase, a purposeful choice sample for interviews was selected from the quantitative sample. Purposive sampling is a type of non-probability sampling, which is based on the knowledge a researcher has of the population and its elements (Babbie & Mouton 2007). This sampling method was relevant for the study as the researcher wanted pre-service accounting teachers to elaborate on their quantitative responses. The sample size consisted of 18 pre-service accounting teachers (six each from first-, second- and third-year of study).

Attitudes of parents and teachers towards the mathematics scales

The Fennema–Sherman mother's, father's and teachers' attitude to mathematics scales, with established reliability and validity, were used with minor changes to suite the South African context. The mother/father scales attempt to measure students' perception of their mother's and father's interest, encouragement and confidence in the student's ability. The teacher scale attempts to measure students' perceptions of their teachers' attitudes to them as learners of mathematics. Each scale consisted of 12 statements, which attempted to measure students' perceptions of their parents' and teachers' attitude towards mathematics (Fennema & Sherman 1976). The first six statements measure positive attitudes, and the next six measure negative attitudes, with the following possible responses: strongly agree, agree, not sure, disagree and strongly disagree. Each of the Likert responses was given a value of 5 to 1, respectively, for the positively stated questions, and 1 to 5, respectively, for the negatively stated questions. A minimum possible score was 12, average possible score was 36 and the maximum possible score was 60. A higher score indicates my father or mother or teacher support(s) or affirm(s) my efforts in mathematics. A lower score indicates my father or mother or teacher does/do not support or affirm my efforts in mathematics.

Being an insider at the HEI gave me the opportunity of gathering data from participants in a natural setting. The questionnaire was distributed in the accounting period during the second week of the first semester, under the supervision of the researcher. The respondents were told that their responses would be confidential and anonymous. All questionnaires distributed were received on the same day, although some pre-service teachers did not want to be part of the study. Where a questionnaire was not answered in full, the questionnaire was excluded from the analysis to avoid bias.

The scales relating to father's and mother's attitudes towards mathematics are both the same and are combined (Table 1): composite statement: my mother/father supports and affirms my efforts in mathematics.

The scale relating to teacher's attitude towards mathematics (Table 2): Composite statement: My teacher supported and affirmed my efforts in mathematics.

TABLE 1: Mother's/father's encouragement and support subscales.

Statement	Mathematics
Statement 1	My mother/father thinks I can be good in maths.
Statement 2	My mother/father thinks I am the kind of person who can do well in maths.
Statement 3	My mother/father has always been interested in my progress in maths.
Statement 4	My mother/father has encouraged me to do well in maths.
Statement 5	My mother/father thinks maths is one of the most important subjects to study.
Statement 6	My mother/father thinks I will need maths for my career after I graduate from high school.
Statement 7	*My mother*/father *thinks advanced maths is a waste of time for me.*
Statement 8	*As long as I have passed, my mother*/father *does not care how I do in maths.*
Statement 9	*My mother*/father *would not encourage me to plan a career in maths.*
Statement 10	*My mother*/father *does not care if I take advanced maths courses.*
Statement 11	*My mother*/father *thinks that just a little maths is all you need to know.*
Statement 12	*My mother*/father *hates to do maths*

Note: Negative worded statements are listed in italics.

TABLE 2: Teacher's encouragement and support subscale.

Statement	Mathematics
Statement 1	My teachers encouraged me to study more maths.
Statement 2	My teachers think I am the kind of student who could do well in maths.
Statement 3	Maths teachers have made me feel that I have the ability to do a lot of maths.
Statement 4	My maths teachers encouraged me to do all of the maths I can.
Statement 5	My maths teachers have been interested in my progress in maths.
Statement 6	I would like to talk to my maths teacher about careers that use maths.
Statement 7	*When it comes to anything serious, I have felt ignored when I try to talk to the maths teacher.*
Statement 8	*I have found it hard to win the respect of maths teachers.*
Statement 9	*My teachers think advanced maths is a waste of time for me.*
Statement 10	*Getting a maths teacher to take me seriously is usually a problem.*
Statement 11	*My teachers would think I was kidding if I told them I was interested in a career in maths.*
Statement 12	*I have had a hard time getting teachers to talk seriously about maths.*

Note: Negative worded statements are listed in italics.

Interviews

Attitudes of parents and teachers towards mathematics

The researcher personally conducted individual, face-to-face, open-ended interviews with 18 pre-service accounting teachers. Maree (2007) described open-ended interviews take the form of a conversation where the researcher's intention is to explore participant views, ideas, beliefs and attitudes about certain events or phenomena. Participants may propose solutions or provide insights into events, but the focus is mainly on their own perceptions of the event or phenomenon being studied. Creswell (2009) suggested that even if the interview is taped, researchers must take notes, in the event that the recording equipment fails. Permission must be obtained from the participants before beginning to record. The interviews in this study were used to elaborate or explain in more detail the data collected in the questionnaires. The interviews provided the researcher with in-depth answers because the participants had been given questions a day before the interview for them to prepare themselves. Probing questions were asked. The time for each interview varied; on average, each interview lasted for about 45 min. The researcher can influence the data in terms of leading on or influencing the respondent's responses (Pillay 2008). If the researcher and the subject know each other, as is the case in my situation as lecturer, there might be a tendency for the respondent to give information that he or she knows that the interviewer would want to hear. As the insider (lecturer) and outsider (researcher), I tried not to influence the interviews.

The interview schedule was constructed from Fennema–Sherman Mathematics Attitude Scale and from literature identified and developed in the literature review. Creswell (2008:161) advised that researchers should use attitudinal measures when they measure feelings towards educational topics, such as in assessing positive or negative attitudes towards mathematics. In constructing the interview schedule, the researcher took note of various factors indicated by Cooper and Schindler (2008:303–309) that influence the reliability, validity and practicality of a measurement scale.

Rating scale: Participants score an object or indicant without making a direct comparison to another object or attitude (e.g. a 5-point rating scale). Cohen, Manion and Marrison (2007) noted that rating scales are useful for tapping attitudes, perceptions and opinions of responses (Figure 1).

People explained which sections of mathematics would help me in accounting.

Indicate your agreement with this statement :

Not applicable	Strongly agree	Agree	Undecided	Disagree	Strongly disagree

If agree, who? _____Explain: _____

If disagree, why not? _____

FIGURE 1: Example of a Likert-scale question used in a survey via interview.

The responses required participants to explain or give reasons for their choices while answering the semi-structured questions. According to Ivankova, Creswell and Plano (2007), interview participants shared their views about experiences with the phenomenon.

Multiple-response (checklist) question and ranking scale: This is a form of multiple-choice question in which respondents are instructed to check all response options that apply. Multiple-response question is also called checklist questions, because a list of all relevant items is provided for the respondent to check off. The N column indicates how many respondents (counts) mentioned each location, and these counts are put in rank order (Table 3).

Sorting: Participants sort cards (representing concepts or constructs). Cards might contain photos, images or verbal statements. In the study, participants were given cards with words. Choose words that are applicable to you when you are performing mathematical accounting calculations (Figure 2).

Who were the influential people in your mathematics study or life? Choose from cards and arrange in rank order.

Accounting scenario: Describe the class environment when the teacher performed mathematical accounting calculations.

The qualitative data gathering phase began with a pilot study, the purpose of which was to clarify the wording of questions and check the suitability of the survey via interviews to best obtain accurate information. The pre-test of the survey via interview was conducted by asking colleagues and supervisors at the university to read and respond to the questions regarding clarity and wording of questions. The interviewer piloted the survey to two pre-service accounting teachers to check if interviewees understood the questions.

TABLE3: Example of (multiple-choice and ranking-scale) question used in a survey via interview.

Influential people (You can choose more than one)	Rank order
Father	
Mother	
Teacher	
Siblings	
Friend	
Coach	
Other family members	

CARDS (Interviewee to arrange in rank order and interviewer to record final decision)

Father | Teacher | Friend | Other family members | Mother | Siblings | Coach

Can you explain how they influenced you? _____

FIGURE 2: Choose words that are applicable to you when you are performing mathematical accounting calculations and arrange in rank order.

Data analysis

According to Sekaran and Bougie (2009), inferential statistics allow the researcher to draw inferences about the population from the sample. For the results of the study, SPSS version 21.0 (SPSS Inc., Chicago, Illinois, USA) was used to analyse the data; $p < 0.05$ and $p < 0.01$ were considered as statistically significant. Analysis of variance was used to compare the mean scores across biographical variables using the parametric Analysis of Variance (ANOVA). The results were confirmed using the non-parametric Kruskal–Wallis ANOVA. The *t*-test was used to compare the mean scores between males and females, using the parametric independent samples *t*-test. The results were confirmed using the non-parametric Mann–Whitney test.

The interviews were taped and the researcher took notes. Permission was obtained from participants before beginning to record. The interview responses of the 18 pre-service teachers were transcribed to produce a written document. The interview responses coded and the salient points that emerged were categorised into themes. The analysed transcripts were presented to academic workshop, panel of supervisors and postgraduate seminar for critical review.

Reliability, validity and trustworthiness

Cronbach's coefficient alpha is a popular reliability test used for the purposes of establishing the internal consistency of a multi-item measurement (Sekaran 2003). A reliability coefficient less than 0.50 is unacceptable, between 0.5 and 0.60 is regarded as significant and above 0.70 is regarded as good. The reliability coefficient cannot be less than 0 or more than 1. For this study, the Cronbach's alpha was computed to determine reliability, and factor analysis was computed to test validity. The Cronbach's alpha computations for the Fennema-Sherman Scales are shown in Table 4.

A summary of the strategies and the criteria used to establish trustworthiness are as follows: credibility (interview technique) – voice recordings of interviews; transferability (dense description) – verbatim quotes from interviews; dependability (dependability audit) – interviews transcripts; and confirmability (confirmability audit) – transcripts checked and participants' written responses checked. Member checks and peer confirmation of interpretations were done. The School of Education Cluster Seminar space was used to enable peers, PhD students, PhD staff and professors to confirm data analysis. To ensure reliability, transcribed version of data from interviews was e-mailed to participants for verification.

TABLE 4: Reliability statistics for the variables.

Fennema–Sherman scales	Cronbach's alpha	
	Current study	Reported F-SS
Mother's mathematics attitude	0.842	0.86
Father's mathematics attitude	0.913	0.91
Teacher's mathematics attitude	0.824	0.88

F-SS, Fennema-Sherman Scales.

Triangulation

Methodological triangulation was used to verify information collected from various data collection sources (questionnaires and interviews), which increased validity and reliability of the research. Data triangulation was used to combine quantitative data obtained from questionnaires completed with qualitative data obtained from interviews and with previously completed research found in the literature study.

Ethical consideration

The study targeted all pre-service accounting teachers at the HEI who were requested to participate in the study and were informed verbally and in writing that their participation in this study was voluntary. The respondents were told that no identifying information was to be disclosed on the questionnaire, and for this reason the interview was conducted anonymously. Participants were told that fictitious names would be used. Participants were also assured that their participation or non-participation would not affect their marks or disadvantage them in any way. This gave respondents the assurance of confidentiality and anonymity. The research complied with ethical considerations for dealing with human subjects. Ethical clearance (HSS/0117/013D) was obtained from the Human Research Ethics Committee of the HEI.

Results

Two sources of data were obtained from the F-SMAS survey and the interview instruments.

Pre-service teachers' perception of support of mother and/or father

Overall, the mean score for all 255 respondents was 46.85 (standard deviation [SD] = 8.56), which represents slightly moderate agreement with the composite statement, 'My mother supports and affirms my efforts in mathematics'. This result is similar to the overall mean of 46.15 (SD = 10.25) for the agreement with the composite statement, 'My father supports and affirms my efforts in mathematics'. A summary of the responses is presented in Table 5 for mother support and affirmation subscale. The 12 items in combination tested agreement on the construct of mother support and affirmation.

Tables 6 shows perceived support of mother with variables using means, *t*-test and ANOVA.

Table 7 shows perceived support of father with variables using means, *t*-test & ANOVA.

Pre-service teachers' perception of support of teachers and peers at school

Overall, the mean score for all 255 respondents was 47.31 (SD = 7.82), which represents moderate agreement with the composite statement, 'My teacher supported and affirmed my efforts in mathematics'. Teacher support and affirmation subscale, a summary of the responses is presented in Table 8.

TABLE 5: Number of pre-service teachers selecting each level of agreement on mother support and affirmation scale.

F-SMAS item in the Mother's support and affirmation domain (N = 255)	Strongly agree (n)	Agree (n)	Undecided (n)	Disagree (n)	Strongly disagree (n)
My mother thinks I am the kind of person who can do well in maths.	95	90	27	24	19
My mother thinks I can be good in maths.	89	116	20	20	10
My mother has always been interested in my progress in maths.	81	92	31	27	24
My mother has encouraged me to do well in maths.	115	86	16	20	18
My mother thinks maths is one of the most important subjects to study.	111	74	31	25	13
My mother thinks I will need maths for my career after I graduate from high school.	82	84	30	39	20
My mother thinks advanced maths is a waste of time for me.	5	11	36	80	123
As long as I have passed, my mother does not care how I do in maths.	20	25	15	88	107
My mother would not encourage me to plan a career in maths.	10	23	42	81	99
My mother does not care if I take advanced maths courses.	14	30	47	74	90
My mother thinks that just a little maths is all you need to know.	13	25	41	85	91
My mother hates to do maths.	13	15	50	57	120

Note: Negative worded statements are listed in italics.

TABLE 6: Comparison: perceived support of mother with variables using means, *t*-test and ANOVA.

Variables	N	Mean	*t*-test			ANOVA	
			T	*df*	*P*	*F*	*P*
Gender	-	-	**-1.622**	**253**	**0.106**	-	-
Male	105	45.82	-	-	-	-	-
Female	150	47.58	-	-	-	-	-
Age (years)	-	-	**0.575**	**253**	**0.635**	-	-
18–20 years	165	46.67	-	-	-	-	-
21 years and above	90	47.20	-	-	-	-	-
Race group	-	-	**-2.864**	**253**	**0.005***	-	-
African	225	46.30	-	-	-	-	-
Indian	30	51.00	-	-	-	-	-
Mother tongue	-	-	**2.400**	**253**	**0.017***	-	-
English	32	50.22	-	-	-	-	-
isiZulu	223	46.37	-	-	-	-	-
Grade 12 mathematics	-	-	**1.891**	**253**	**0.060**	-	-
Mathematics	146	47.73	-	-	-	-	-
Mathematical literacy	109	45.69	-	-	-	-	-
Accounting module	-	-	-	-	-	**2.572**	**0.078**
First year	143	47.92	-	-	-	-	-
Second year	77	45.44	-	-	-	-	-
Third year	35	45.60	-	-	-	-	-
Areas/location of school	-	-	-	-	-	**3.304**	**0.038***
Rural area	134	46.16	-	-	-	-	-
Township area	72	46.25	-	-	-	-	-
Suburban area	49	49.65	-	-	-	-	-

ANOVA, Analysis of variance.
*, significant at the 0.05 level, $p < 0.050$.

TABLE 7: Comparison: perceived support of father with variables using means, *t*-test and ANOVA.

Variables	N	Mean	*t*-test			ANOVA	
			T	*df*	*P*	*F*	*P*
Gender	-	-	**-2.652**	**253**	**0.009***	-	-
Male	105	44.14	-	-	-	-	-
Female	150	47.56	-	-	-	-	-
Age (years)	-	-	**-0.233**	**253**	**0.816**	-	-
18–20 years	165	46.04	-	-	-	-	-
21 years and above	90	46.36	-	-	-	-	-
Race group	-	-	**-3.558**	**253**	**0.000***	-	-
African	225	45.34	-	-	-	-	-
Indian	30	52.27	-	-	-	-	-
Mother tongue	-	-	**3.058**	**253**	**0.002***	-	-
English	32	51.25	-	-	-	-	-
isiZulu	223	45.42	-	-	-	-	-
Grade 12 mathematics	-	-	**2.034**	**253**	**0.043***	-	-
Mathematics	146	47.27	-	-	-	-	-
Mathematical literacy	109	45.69	-	-	-	-	-
Accounting module	-	-	-	-	-	**0.910**	**0.404**
First year	143	46.92	-	-	-	-	-
Second year	77	45.26	-	-	-	-	-
Third year	35	45.00	-	-	-	-	-
Areas/location of school	-	-	-	-	-	**3.539**	**0.030***
Rural area	134	45.11	-	-	-	-	-
Township area	72	45.76	-	-	-	-	-
Suburban area	49	49.57	-	-	-	-	-

ANOVA, Analysis of variance.
*, significant at the 0.05 level, $p < 0.050$.

The 12 items in combination tested agreement on the construct of teacher support and affirmation.

Table 9 shows perceived support of mother with variables using means, *t*-test & ANOVA.

Interviews on student perceptions of support of family member.

Influential people in mathematics

The interviewees were given cards with out-of-home factors and in-home-factors to arrange in rank order, and the interviewer recorded the final decision (Table 10).

The results indicate that the out-of-home influences, that is, teacher and friends, were ranked higher than home influences, that is, mother, father and siblings. All (18) participants chose their teachers as their most important influence, 12 participants chose their friends as their second most important influence, eight participants chose their mothers as their third most important influence, seven participants chose their siblings as their fourth most important influence, six participants chose their fathers as their fifth most important influence and two participants chose their coaches as their sixth most important influence in mathematics.

Mother's influence

> 'Mother – She always encouraged me to do my best and try harder no matter what. She told me never to give up and always try harder. She was persistent in motivating and encouraging me.' (Bima, 01, 25 March 2014)

TABLE 8: Number of pre-service teachers selecting each level of agreement on teacher's support and affirmation domain.

F-SMAS item in the teachers support and affirmation domain (N = 255)	Strongly agree (n)	Agree (n)	Undecided (n)	Disagree (n)	Strongly disagree (n)
My teachers encouraged me to study more maths.	147	77	7	14	10
My teachers think I am the kind of student who could do well in maths.	119	88	28	13	7
Maths teachers have made me feel that I have the ability to do a lot of maths.	104	98	23	20	10
My maths teachers encouraged me to do all of the maths I can.	120	100	16	13	6
My maths teachers have been interested in my progress in maths.	112	94	20	22	7
I would like to talk to my maths teacher about careers that use maths.	71	78	50	46	10
When it comes to anything serious, I have felt ignored when I try to talk to the maths teacher.	9	38	36	108	64
I have found it hard to win the respect of maths teachers.	14	45	27	97	72
My teachers think advanced maths is a waste of time for me.	2	15	24	82	132
Getting a maths teacher to take me seriously is usually a problem.	13	34	27	91	90
My teachers would think I was kidding if I told them I was interested in a career in maths.	19	29	34	83	89
I have had a hard time getting teachers to talk seriously about maths.	26	34	36	78	81

F-STS, Fennema Sherman Teacher's Scale.

Note: Negative worded statements are listed in italics.

TABLE 9: Comparison: perceived support of teacher with demographic variables using means, *t*-test and ANOVA.

Variables	N	Mean	*t*-test			ANOVA	
			T	df	P	F	P
Gender	-	-	**-2.727**	**2.53**	**0.007***	-	-
Male	105	45.73	-	-	-	-	-
Female	150	48.41	-	-	-	-	-
Age (years)	-	-	**0.651**	**253**	**0.516**	-	-
18–20 years	165	47.55	-	-	-	-	-
21 years and above	90	46.88	-	-	-	-	-
Race group	-	-	**-2.094**	**253**	**0.037***	-	-
African	225	46.94	-	-	-	-	-
Indian	30	50.10	-	-	-	-	-
Mother tongue	-	-	**2.443**	**253**	**0.015***	-	-
English	32	50.44	-	-	-	-	-
isiZulu	223	46.86	-	-	-	-	-
Grade 12 mathematics	-	-	**3.141**	**253**	**0.002***	-	-
Mathematics	146	48.62	-	-	-	-	-
Mathematical Literacy	109	45.56	-	-	-	-	-
Accounting module	-	-	-	-	-	**2.832**	**0.061**
First year	143	48.29	-	-	-	-	-
Second year	77	45.73	-	-	-	-	-
Third year	35	46.77	-	-	-	-	-
Areas/location of school	-	-	-	-	-	**3.981**	**0.020***
Rural area	134	46.45	-	-	-	-	-
Township area	72	47.04	-	-	-	-	-
Suburban area	49	50.06	-	-	-	-	-

*significant at the 0.05 level, $p < 0.050$.

TABLE 10: Influential people in mathematics (multiple response and rank order).

Variable	Ranking order	
	Count	N
Teacher	1	18
Friend	2	12
Mother	3	8
Siblings	4	7
Father	5	6
Coach	6	2

The response indicates that the parent is supportive, she is a non-judgemental parent who is not putting undue stress on the student by saying, 'do your best based on your effort'. Non-judgemental support by parents and not putting undue stress on the child are likely to create positive attitudes towards mathematics even if the student is not a high-flyer in mathematics. Parents who encourage their children to be persistent, to develop endurance and to stick to the task, even if initial stages are difficult, can help them develop positive attitudes towards mathematics. Encouraging, motivating, supporting students and developing positive attitudes towards mathematics must be ongoing, not just once-off, as there needs to be a continuous feeling of positive energy towards the discipline. When children have this kind of support, they are likely to benefit from it:

> 'Mother – told me to do mathematics because required for B Com degree. To get a good job and earn well in future I must do mathematics.' (Mara, 02, 25 March 2014)

The parent is informed and is linking mathematics to a vocation. Mara is indicating that her parent recognises the importance of mathematics for getting employment and earning a good salary. The mother is linking mathematics competence with good occupation and good remuneration. These are motivating factors in developing positive attitudes towards mathematics:

> 'Mother – sent me for extra mathematics tuition and ensured that I studied at home.' (Vender, 03, 24 March 2014)

Vender's parent is prepared to spend further financial resources to provide additional mathematics support if she thinks that her child is not getting enough. This is a parent who has taken extra steps to help develop Vender's mathematics. The mother is a highly vigilant parent who drives the child's success in mathematics. Highly vigilant parents are likely to generate positive attitudes towards mathematics and its study.

Father's influence

> 'My Dad always motivated me to work hard in mathematics and he was really proud when I obtained good results. His career is in mathematics and he wanted me to pursue that as well.' (Narri, 04, 25 March 2014)

Narri wants to be affirmed and recognised by her father. She wants to please her parent. In order to please her father, she is likely to work hard. Parents, who set high expectations and

motivate their children, encourage the children to follow their own example and to meet the expectations. Parents who are knowledgeable in mathematics set the bar high and encourage students, and the students in turn wish to please their parents.

Sibling influences

Family members other than mother or father may also be involved in the education of students:

> 'My brother, although he did not do mathematics at school but at university he experienced that mathematics is important. He encouraged me to take maths because it is required at university.' (Sibo, 05, 25 March 2014)

Sibo's brother has knowledge of university expectations:

> 'My uncle on the other hand motivated me and I used to consult him as well if I have challenges in mathematics.' (Wandi, 06, 26 March 2014)

In this case, someone outside of the immediate family has been a resource or a role model. If there is no resource, students are likely to develop negative attitudes towards mathematics. If there is a resource outside of family, for example, an uncle, students are likely to develop positive attitudes towards mathematics.

Interviews on student perceptions of teachers and peers mathematics attitude at school

Teachers' and friends' roles in influencing participants are most important, as they were ranked higher than the role of parents and siblings. All the participants reported that teachers greatly influenced their thinking and understanding of mathematics. However, two-thirds of participants also indicated that friends influenced their study of mathematics. The participants valued the role played by teachers and friends. Participants' perceptions of teacher and friend support are directly linked to out-of-home drivers, such as interest, encouragement, confidence, behaviour, support, advice, motivation and teaching methods, which influence participants to like mathematics. This is reflected in what students said.

Teacher influences

> 'Teacher – always motivated us to work hard and did her best to teach us. Organised extra lessons and checked sections we need help on.' (Vender, 03, 25 March 2014)

A committed teacher, who shows interest in her students, is likely to instil a positive attitude in learners. The response indicates that the mathematics teacher motivated learners and influenced them to like mathematics. The learners felt more valued in the learning process because the teacher showed an interest and increased engagement in mathematics teaching and learning. The teacher went an extra mile by organising academic support that enhanced the learners' motivation level. The teacher also supported learners with problematic mathematics topics:

> 'First, my mathematics teacher, he was so good in teaching mathematics such that he became my role model. He was enthusiastic and energetic in all he does. He explained and taught thoroughly, made everything simple.' (Wandi, 06, 26 March 2014)

Competent mathematics teachers are more likely to be good role models and an influencing factor than teachers with shaky knowledge who are likely to demotivate their students. A good mathematics teacher shows some confidence and can also instil confidence. The teacher described in the response is meticulous, pays attention to detail, and has passion and energy, attributes which are likely to instil positive feelings. Teachers who make complex tasks accessible and reduce complexity in ways that allow understanding are likely to engender positive attitude in learners, because they are then less likely to see mathematics as a complex or difficult subject. A good teacher is someone who wants to instil positive attitude, is not a strict disciplinarian and will look for interesting ways to present complex material by proceeding from the known to the unknown, in contrast to a demotivating teacher who walks in and says that, 'this subject is not for you, it is tough and hard, you can't make it'. A teacher who presents mathematics in a negative manner discourages the student, whereas an inspiring teacher will create expectations and present mathematics in a way that enhances students' understanding of difficult concepts. Creative teaching can change attitudes:

> 'My teacher played the greatest influence. When I was in high school I did not enjoy mathematics, but, when I was in Grade 11 and 12 my mathematics teacher had a great influence on my mathematics life. His teaching methods created an interest in me to like mathematics and he was always willing to help when I found certain areas in mathematics difficult.' (Narri, 04, 25 March 2014)

Good teachers can change attitudes. Once students develop negative attitudes, those attitudes remain. The above response shows that teachers who use creative methods in teaching can change attitudes. 'He was always willing to help' shows that teachers who make it clear that their job is to help and support children can change the attitude of learners towards the subject. There are teachers who are reluctant to do a little bit more, and this can come across through words, dispositions and tones. A teacher may say, 'Do not ask me anything else because I taught you'. However, teachers whose disposition is welcoming and open, who invite students to ask for assistance and show willingness to respond to them, are the ones who are likely to change students' attitudes:

> 'My teacher used to ask me to teach the whole class, so I was supposed to make sure that I go to class knowing everything with the particular topic. Even my mother wanted me to teach her mathematics as if she still studying, so I had to ensure that I know everything.' (Wise, 07, 26 March 2014)

> 'My teacher always inspired me in an amazing way. She would ask me to teach my fellow learners in class if I have aced a test or examination, sometimes she granted me opportunities, which exposed me to Mathematical Literacy. For example, attending workshops programme with other learners from other schools in my region.' (Kazi, 08, 26 March 2014)

One way a teacher can show that she has confidence in a learner is to invite the learner to take on a higher level of responsibility in mathematics, such as teaching fellow learners. The learner undertaking this task then feels a sense of responsibility to satisfy the teacher and do a good job. This kind of added responsibility results in students wanting to deepen their own understanding, so that they are ready to accept the additional responsibility bestowed on them by the teacher. The teachers described in these responses showed confidence in learners and trusted them to be peer teachers – a role in which the learner needs to be strong in knowledge. In the first response, a wise mother recognises that her son has mathematical ability, which means that two key adults are affirming this student, the teacher in one way and the parent in another way. In a parent–child relationship, the parent is powerful and the child is subordinate, but here the parent has inverted this relationship by saying 'teach me mathematics'. It is self-affirming and self-fulfilling that the child can teach the mother mathematics.

Friend influences

> 'Friend – studied mathematics together and helped me understand things I don't know.' (Vender, 03, 25 March 2014)

Vender indicates that friends have been an important positive influence in her attitudes towards mathematics, and that they can be a valuable resource for learning mathematics. She recognises that mathematics is not an individual pursuit and can be learnt with others, which she found beneficial in that it led her to attach meaning to unfamiliar concepts. When students develop trusting relationships that become friendship, they see friends as resources that could assist them in advancing their understanding of mathematics:

> 'A friend advised me to study mathematics because it will help me when I choose the university courses because many accounting causes require mathematics.' (Phindi, 09, 26 March 2014)

Knowledgeable friends who understand university expectations and prerequisites for certain courses, accounting in particular, are well placed to advise students about taking mathematics as a subject. In a context where students do not have role models or friends with some university experience, lack of key information about career and course choices at university could lead to wrong choices. Having friends who can give this information is a powerful resource:

> 'Well, in Grade 11 my friends wanted us to change from pure mathematics to Mathematical Literacy because they were struggling. So because I wanted to be in the same class with my friends I also changed but my siblings did not take this quite well.' (Khoba, 10, 26 March 2014)

Friends' influence could however be negative. If individuals in a group of young learners (such as Grade 11 learners) develop negative attitudes towards mathematics as a result of their own personal difficulties or struggles with mathematics, they are likely to influence their peers negatively as well. When a group with an 'us' mentality and attitudes towards mathematics gains momentum, it is likely to swing those who are undecided in a negative direction. This kind of momentum can be even more powerful than family motivation.

At this young age, students are unable to self-diagnose their ability to do pure mathematics and may be easily susceptible to group pressure. Without a good teacher who can diagnose a student's capacity at Grade 10 or 11 and say to the student, 'I have seen your work and abilities in mathematics. You could do pure mathematics', negative peer pressure can easily be damaging.

Discussion of research results

Pre-service teachers' perception of support of family members in the home

There are different degrees of support. Most students agreed on the significance of support from the home, whether from mother or father or from siblings or other relatives. Should the instrument be used again, it would be appropriate for the South African environment to talk about support from family members, rather than simply from mother and father. This claim is discussed below, drawing on the results of F-SMAS, the student interviews and the literature.

The results of the study showed that mothers were mentioned more often than any other family member. Nevertheless, mothers were ranked lower. This finding is not consistent with Hurst's (2012) finding that fathers were mentioned much more often than any other family member. Only a minority (28) of the respondents were in agreement with the statement, 'My mother/father hates to do maths'. However, a majority of the respondents (184) were in agreement that, 'My mother thinks maths is one of the most important subjects to study'. It emerged from the interviews that highly vigilant parents are likely to encourage positive attitudes towards mathematics and the study of it, and that such parents are prepared to spend additional financial resources to provide extra mathematics support. An overwhelming majority (205) of the respondents were in agreement that, 'My mother thinks I can be good in maths', with a minority (30) who believed that their mothers did not think that they could do mathematics. Participants stressed that non-judgemental support from parents and not putting stress on the child are likely to create a positive attitude towards mathematics, even if the student is not a high-flyer in mathematics. This kind of support or encouragement must be ongoing. The majority of the respondents (180) were in disagreement with the statement that, 'My mother would not encourage me to plan a career in maths'. Interview participants pointed out that parents who link mathematics competence with motivation factors, such as good occupation and good remuneration, are likely to encourage positive attitudes towards mathematics. A significant number of the respondents (189) agreed that, 'My father has encouraged me to do well in maths', and 173 of them agreed that, 'My father has always been interested in progress in mathematics'. From the interviews, it transpired that if parents who are knowledgeable in mathematics set high expectations and

motivate their children, students will want to please their parents by getting good results. Studies by Scarpello (2005) and Köğce et al. (2009) supported the views expressed above.

The ranking order for influential people in mathematics showed that parents were ranked lower by participants, as the majority indicated parents were not educated. In addition, in the South African context, it does not serve to say 'my father' or 'my mother' because there are many single-headed families where, for example, a grandmother or uncle or sibling is the caregiver in the household. Students may select 'strongly disagree' because the parent is not there. Finally, the results showed that another relative (e.g. an uncle, brother, sister, etc.) who is knowledgeable in mathematics could be a resource or role model for students. Hence, students are likely to develop positive attitudes towards mathematics. If I were to redo the questionnaire, instead of 'mother' and 'father', I could use 'my family'. To promote parental and sibling involvement in mathematics, South Africa should copy the family mathematics programme in Canada that has assisted in promoting a positive attitude towards mathematics in both parents and their children. The main aim of the programme was to encourage parental involvement in their children's mathematics education. The majority of parents' comments reported that understanding 'why' had made the learning more meaningful and enjoyable for them. Involving parents and siblings (in case parents are not educated) could, in the family mathematics programme, be a very positive contributor in improving attitudes towards mathematics (Onslow 1992).

Pre-service teachers' perception of support of teachers and peers at school

More students 'strongly agreed' that the support came from school. Support came from teachers and peers and friends. Teachers and friends therefore play an important role in developing positive attitudes towards mathematics. This claim is discussed below, drawing on the results of F-SMAS, the student interviews and the literature.

From interviews, participants saw teachers and friends and peers as more significant contributors to their mathematics learning than parents and siblings. The participants' perceptions of support and affirmation by teachers and friends of their efforts in mathematics were directly linked to the out-of-home drivers, such as interest, encouragement, confidence, behaviour, support, advice, motivation and teaching methods, because they influence participants to like mathematics. In a South African context, teachers and friends and peers play a more important role in developing positive attitudes towards mathematics than do parents and siblings. This places a huge responsibility on the South African government and citizens at large to signal their commitment to improving the quality of mathematics in South Africa. The drive to instil a love of mathematics is not coming from home because it appears that there is no culture of strongly positive attitudes towards mathematics among the South African population.

A majority of the respondents (224) agreed that their teachers encouraged them to study more mathematics. This is reflected in participants' responses that teachers who show interest in their students (motivating, supporting, empowering and going an extra mile by organising academic support) are likely to instil a positive attitude in students. The results also showed that competent mathematics teachers are likely to be good role models – motivating students, instilling confidence and positive attitudes towards mathematics. Teachers with passion and energy are likely to instil positive attitudes towards mathematics. A good teacher will not present mathematics as tough, and will look for interesting and fascinating ways to present complex material for a new topic. Teachers who use creative methods in teaching can change attitudes. Teachers who project a disposition of welcoming or openness, who encourage requests for assistance and show willingness to respond to them are likely to change students' attitudes. These results are consistent with findings in previous research (Bandura 1986; Daniels & Arapostathis 2005; Fast et al. 2010; Jadwiga 2009; Mensah et al. 2013; Okafor & Anaduaka 2013; Vandecandelaere et al. 2012). When a teacher shows that he or she has confidence in a learner and invites learners to take on a high level of responsibilities in mathematics like teaching fellow learners (peer teaching), the added responsibility results in students wanting to deepen their own understanding, so that they are better prepared for the additional responsibility bestowed on them by the teacher. This finding is consistent with earlier studies (Daniels & Arapostathis 2005; Mensah et al. 2013; Odiri 2011).

A majority of the respondents (202) agreed that their maths teachers have made them feel that they have the ability to do a lot of maths, while only a minority (30) disagreed with the statement. The majority of participants reported that they were positively influenced by their teachers to work hard in mathematics, although 59 (23.1%) were in agreement that, 'I have found it hard to win the respect of maths teachers'. Some participants pointed out that they were negatively influenced by teachers and that this contributed to failure and dislike of mathematics, which resulted in poor performance.

In the South African context, participants indicated that friends and peers play an important part in their attitudes towards mathematics, although the nature of influence can be positive or negative. This finding is supported by Naidoo (2011) and Stuart (2000), and in terms of positive influence by friends and peers, one participant indicated that friendship is a valuable resource for learning mathematics and could positively influence attitudes towards mathematics. The participant also recognised that mathematics is not an individual pursuit and could be learnt with friends or peers. This finding is supported by Noble (2011), who found that vicarious experience was more influential than enactive attainment and mastery experiences for the students, but contradicts Bandura (1986, 1997) who claimed that enactive attainment has the

most significant impact on self-efficacy. Where trust exists among friends or peers, the benefits for learning mathematics may be greater than for students working in isolation; friends and peers are intrinsically and extrinsically motivated to enhance their confidence and attitudes towards mathematics (Deacon & Edwards 2012). Another participant indicated that having knowledgeable friends who understand university expectations and prerequisites for courses such as accounting are well-placed to advise students about taking mathematics as a subject. This information is a powerful resource because without it a student can make wrong career and course choices. Therefore, information dissemination by friends on issues such as career choices and course selection at the tertiary level are important in getting to spaces where information is not available. This finding is consistent with findings by Stuart (2000) and Naidoo (2011) that peers and friends influence adolescents' career choices. Negative influences by friends are also possible, such as a situation where a group of young learners in Grade 11 develop negative attitudes towards mathematics and pass on that negativity to friends and peers. Negative peer influence can often be more powerful than family motivation to take mathematics, and teachers must be able to diagnose students as early as Grade 10 or Grade 11 who are likely to fall prey to negative peer pressure and negative attitudes towards mathematics. Peers and friends were ranked higher than parents, meaning that peers' and friends' influence towards mathematics is more than parents' influence. Falbo et al. (2001) concurred with this finding and suggested a family mathematics programme that assists in promoting a positive attitude towards mathematics in both parents and their children.

Conclusion

Parents and siblings were ranked lower by students in relation to giving them assistance with mathematics, but their role must not be ignored, as it is mandatory in developing students' positive attitudes towards mathematics. The mother may not be knowledgeable in mathematics but is responsible for nurturing the emotional well-being of the student and monitoring the homework of students. Some of the parents are housewives and part of their job is to take care of student's education. The Indian, English and suburban students perceived their mothers as more encouraging, supporting and affirming their efforts in mathematics, while female, Indian, English, mathematics and suburban students perceived their fathers as more encouraging, supporting and affirming their efforts in mathematics. Siblings in South Africa play an important role in developing positive attitudes towards mathematics as, in some homes, there are no parents.

Teachers' attitudes towards mathematics have a significant impact in shaping students' attitudes towards mathematics in learning accounting. Therefore, a positive attitude on the part of the teacher can enhance the student's attitudes towards mathematics by motivating, supporting, empowering, instilling confidence, employing unique teaching methods, showing willingness and interest, showing openness, having excellent subject knowledge, etc. Teachers and peers and friends were highly ranked by students, and they play an important role in developing positive attitudes towards mathematics. Female, Indian, English, mathematics and suburban students perceived their teachers as more encouraging, supporting and affirming their efforts in mathematics. This is relevant in light of the finding that 224 of the students strongly agreed that their teachers encouraged them to study more mathematics, and 202 of the students were in agreement with the fact that mathematics teachers had made them feel that they have ability to do a lot of mathematics. The results also indicate that peers are a valuable resource for learning mathematics. The benefits for learning mathematics with friends or peers may be greater than when a student is working in isolation. It was found that peers' or friends' influence in mathematics is greater than that of parents. When students develop trusting relationships, they see friends as resources that could assist them in advancing their understanding of mathematics and improving their attitudes towards mathematics.

Family mathematics programmes, seminars or workshops to promote or enhance positive attitudes towards mathematics in parents and other family members should be organised in schools or at tertiary levels. The main aim of such a programme would be to encourage parental involvement in their children's mathematics education, as the study found that participants gave a lower ranking for parents' and sibling's mathematics influence. Perhaps, this initiative could improve the World Economic Forum's last position ranking of South Africa.

Implications for the use of Fennema–Sherman Mathematics mother's, father's and teacher's attitude to mathematics scales in South Africa

For the South African context, it is not acceptable to talk about parents (father and mother) only, as they may no longer be there. It would be more appropriate to refer to 'families', with so many households in South Africa being single-headed by a grandmother or uncle or aunt or brother or sister or other siblings. For the South African context, it was found that peer or friendship teaching/mentoring could be used as a substitute for teachers. Positive peer or friendship influence has been found to contribute positively on attitudes towards mathematics. Teachers should encourage and support positive friends and peers teaching or mentoring in mathematics and accounting, as the benefits of learning mathematics and accounting calculations with peers and friends are greater than working in isolation, and they positively influence attitudes towards mathematics.

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Author's contributions

I declare that I am the sole author of this research article.

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Data availability statement

The data supporting the findings of this study are available within the article. Raw data were generated at the University of KwaZulu-Natal.

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