School and Individual Predictors of Mathematics Achievement in South Africa: The Mediating Role of Learner Aspirations

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Abstract

Extant literature has demonstrated the importance of individual and school-related factors in improving mathematics achievement. Despite this, there is still a gap in research to understand the mediating role of educational aspiration in mathematics achievement. The aim of the present study is to test the relationship between self-efficacy, school resources, positive school climate and mathematics achievement as mediated by learner aspirations. Using a nationally representative sample of 12 514 learners from the Trends in International Mathematics and Science Study (TIMSS) and structural equation modelling (SEM), we determine the model fit of a mediated relationship between self-efficacy, school resources, positive school climate and mathematics achievement. Findings from SEM in addition to good fit indices revealed that self-efficacy, learner aspiration and school resources were positively related to mathematics achievement. However, there was an unexpected negative relationship between positive school climate and achievement. Learner educational aspirations mediated the relationship between positive self-efficacy; positive school climate with achievement. In order to improve educational achievement, interventions must include both the school and individual factors where interactions between positive self-efficacy and aspirations contribute to improved learner achievement.

Keywords: Mathematics Achievement, Self-efficacy, Learner educational aspiration, Positive school climate, School resources

Introduction

Non-cognitive factors including educational aspirations may motivate learners to execute certain cognitive strategies, which may improve performance. These aspirations refer to educational goals that individuals set for themselves. There is evidence indicating that educational aspirations like expecting to attend graduate school is linked to higher achievement because learners are likely to invest the necessary cognitive efforts (Fortin, Oreopoulos, & Phipps, 2015). Moreover, learner educational aspirations have the potential of providing the motivation for achievement. More so, understanding the role of other determinants of achievement are important because of poor educational outcomes especially in low-income contexts in South Africa (Taylor, 2019). Within this context, research on predictors of academic achievement have focused on mostly demographic, socio-economic conditions and cognitive factors (see Mthumiye & Daniels, 2019; Kridiotis, Bezuidenhout, & Raubenheimer, 2016). The exploration of non-cognitive determinants including self-efficacy (Vogel & Human-Vogel, 2016), early learning experiences (Visser, Juan & Hannan, 2019), resource availability, home language and instructional language equivalence has shown to predict mathematics and science achievement (Prinsloo & Harvey, 2018). However, what is still unknown is how aspirations and achievement, together, might be linked to other antecedents including self-efficacy, school climate and resources. For instance, Hardie (2015) and Rubie-Davies (2014) argued that beliefs about learners' academic abilities are determined by their interactions with individuals in different environments including school. Other studies also support the notion that school climate is an important influence on expectations of academic success (Hynds, Averill, Hindle, & Meyer, 2017; Wilson & Reddy, 2020). There is however a gap in research in the South African educational context, testing the joint impact of self-efficacy, school climate and resources on learner educational aspirations (as determinants of achievement) and how this in turn predicts levels of achievement. The aim of the study is to test a model with learner educational aspiration as the mediator to determine whether the levels of aspirations set will affect the relationship between the predictors (self-efficacy, school climate and school resources and mathematics achievement).

Learner educational aspirations and educational achievement

Previous studies on aspirations and school achievement have been concerned with the question of whether or not learner educational aspirations are a vehicle for understanding achievement (Clair, Kintrea, & Houston, 2013; Rose & Baird, 2013). Related to this notion, Khattab (2015) argued that, among Israeli students, holding high aspirations predicted school achievement. Moreover, a South African policy recommendation suggested that non-cognitive factors such as learner educational aspirations are important for improving learner achievement (Yu, Frempong, & Winnaar, 2015). However, there is minimal consensus on the relationship between educational aspiration and achievement. On the one hand, some research evidence has pointed to the relationship between learner educational aspirations and educational achievement (Fortin et al., 2015; Hodis et al., 2015), indicating that holding aspirational goals towards academic achievement was positively related to high grades. Fortin et al. (2015) argued that gender disparities in educational achievement was mostly explainable by the higher levels of aspirations that Canadian adolescent females set for themselves. On the other hand, varying views have emerged indicating that evidence linking raising aspirations with improved school achievement requires further investigation (Carter-Wall & Whitfield, 2012; Darnon, Dompnier, & Poortvliet, 2012; Harder, 2015).

Studies supporting the link between learner educational aspirations and achievement have been based on the rationale that aspirations provide motivation that in turn improve achievement (Harder, 2015). Apart from motivations, aspirations are linked to learner's conception of their ability to succeed (self-efficacy). These psychological variables (motivations and self-efficacy) allow an individual to invest the necessary efforts for achievement (Hynds et al., 2017). A useful explanatory framework for the relationship between aspiration and achievement is the expectancy value theory (Gorard et al., 2012), which states that success in a given task is dependent on the expectancy of success and value placed on achievement-related performance (Eccles, 2009). In the case of our study, this would imply that expectation of success could be an expression of aspirations, which could in turn influence efforts geared towards achieving academic-related tasks.

Self-efficacy and learner academic achievement

The belief in one's ability to succeed is related to achievement in learning domains. Such belief is engendered through confidence in capability to perform tasks (mastery experience), evaluating one's prospect of achieving a task by observing other learners' successful performance (vicarious experience), other individual's evaluation of the learner's capability (social persuasion) and physical experiences when engaging in a specific task (physiological states; Britner & Pajares, 2006). Herrmann, Bager-Elsborg and McCune (2017) found a positive correlation between self-efficacy and learner achievement among a Danish sample of university students. A systematic review of studies between 2003 and 2015, demonstrated that most studies on self-efficacy points to moderate correlations with academic achievement (Honicke & Broadbent, 2016). A contribution of the study, is exploring whether learner aspirations will mediate the relationship between self-efficacy and achievement.

Social cognitive theory by Bandura (2012) argues that external social systems and internal factors regulate behaviours. Self-efficacy is an important part of an individual's internal self-influence that determines their evaluation of their capabilities to engage in a goal-directed behaviour. Within an academic context, self-efficacy is frequently described in terms of academic self-efficacy (ASE), which is defined as a learner's evaluation of their ability to successfully achievement education-related goals (Elias & MacDonald, 2007). In South African schools, evidence has shown that self-efficacy is related to science achievement among Grade 9 learners (Juan, Hannan, & Namome, 2018). Similar findings were obtained among first year chemistry undergraduate students whose scores on self-efficacy predicted their achievement in chemistry (Ramnarain & Ramaila, 2018).

School resources, school climate and achievement

In a review of school resources and educational outcomes, it was demonstrated that there were mixed results in the relationships between school resources and achievement. Whereas textbooks and other pedagogical materials only weakly predicted academic performance, chairs, desks and tables raised test scores (Glewwe, Hanushek, Humpage, & Ravina, 2011), in the context of low income countries. Additionally, computers and related devices were weakly supportive. Similar findings emerged with Jackson, Johnson, and Persico (2016) who argued that increased school spending in the United States of America (USA) was related to better educational outcomes. This increase was more prominent among children from socio-economically disadvantaged backgrounds. These findings highlight the relationship between improved access to school resources and life outcomes of children from economically deprived backgrounds, thereby implying that economic factors play a huge role in determining educational outcomes. In a related study of learner samples from Botswana, Kenya and South Africa, better teaching quality and classroom conditions resulted in learning gains in mathematics (Carnoy, Ngware, & Oketch, 2015).

In South Africa, Visser, Juan and Feza (2015) using the TIMSS 2015 data intimated that it was necessary to explore both home and school resources, when attempting to understand mathematics achievement. Their study showed that the state of the school's physical infrastructure and the availability of learning materials had a positive effect on achievement and larger class sizes had a detrimental effect. In other related studies, there is a general consensus that the availability of school resources is positively related to educational outcomes (Spaull, 2013; van der Berg, 2007). Spaull (2012, 2013) identifies two kinds of schools the South African system has, that is – wealthy better-resourced schools and poorly-resourced schools – and the roles they play in providing proper education to learners. Findings from the study suggested that poor dysfunctional schools have unqualified teachers, while functional schools are able to attract better qualified teachers resulting in higher achievement (Spaull, 2013).

School climate is a multi-dimensional index of the intangible factors that represent the overall social atmosphere of the school (Mullis, Martin, Foy, & Arora 2012), and it is measured as eagerness to be in school and experiencing support from the peers. Studies in different parts of the globe have indicated that schools have the mandate to serve as a responsive, enabling and sustainable environment for learning (Bishop, 2012). Rubie-Davies, Peterson, Sibley, and Rosenthal (2015) argues that schools as instructional and social domains are related to the student motivation and beliefs about capabilities. This is because teachers and peers interact with learners in a manner that determines the extent to which they engage with academic work.

Highlighting the importance of school climate, Khattab (2015) indicated that although high aspirations predicted achievement, it was not adequate, especially among learners from poor households. It was argued that more policy and school-related interventions were required in order for learner aspirations to have intended impact on achievement (Khattab, 2015). Furthermore, it was emphasised that as much as policy-makers and school authorities need to instil aspirations, they also needed to equip learners with necessary skills and provide conducive learning environments in order for aspirations to lead to improved achievement. Similarly, Hynds et al. (2017) indicated that the types of interactions within the school context can determine goals and expectations of success. Hynds et al. (2017) found that learners in New Zealand that experienced encouragement and respect from teachers had higher aspirations and achievement. Hardre (2015) notes that motivations (which are related to aspirations) although internal, are also dependent on the context.

The findings from previous research point to inconclusive inferences on the direct relationships between aspirations and achievement, although there is evidence for the link between self-efficacy, school climate and resources and achievement (see Prinsloo & Harvey, 2018). It is therefore necessary to explore how these variables interact with learner aspiration in predicting learner achievement. Using the Trends in Mathematics and Science data (TIMSS; 2015) from Grade 9 learners in South Africa, the present study aims to investigate the relationships between self-efficacy, school climate and resources and mathematics achievement, testing the mediating role of learner aspirations with the method of structural equation model (SEM).

Research hypothesis

1. There will be direct significant positive relationship between self-efficacy, school climate and resources and mathematics achievement
2. There will be direct significant positive relationship between self-efficacy, school climate and resources and learner educational aspiration
3. Learner aspiration will be positively related to achievement
4. There will be a significant mediated relationship between the predictors (self-efficacy, school climate and resources) and learner achievement via learner educational aspirations.

Methods

Sample and participants

The TIMSS 2015 school sample for South Africa was drawn from the 2013 Department of Basic Education list of all schools in South Africa, which comprised 10,009 schools (9,099 public and 910 independent schools), that offered Grade 9 classes. A total of 300 schools were sampled, of which 292 agreed to participate in the study. A total of 12, 514 learners, 334 mathematics and 331 science teachers participated in the study conducted by the Human Sciences Research Council. Statistics Canada drew the nationally representative sample from the 2013 Department of Basic Education list of all schools in South Africa. The sample was selected using 'province' as an explicit stratification variable and the 'school poverty index' as an implicit stratification variable. Although the data is 5 years old, it is the most up-to-date TIMSS data and is the only nationally representative data at the learner and school level.

Instruments

In this study, we included the following indices, self-efficacy, school resources (serving as socio-economic indices), school climate, learner educational aspirations and mathematics achievement. For the school resource scale, an index was created by TIMSS indicating the extent to which the school's instructional capacity was affected by the shortage of learning resources. These included instructional materials, school supplies, school buildings, instructional space and computer technology for teaching and learning. The instrument was rated from *Not Affected to Affected A lot*. Self-efficacy was measured using 8-items tapping into learner's assessment of their ability in relation to mathematics achievement and this was scored on a Likert-type scale ranging from *1 (Agree a lot) to 4 (Never or almost never)*. Items include 'I usually do well in Mathematics'; 'Mathematics is

not one of my strengths'; I learn things quickly in Mathematics'(mastery experience); 'Mathematics is more difficult for me than for many of my classmates' (vicarious experiences); 'My teacher tells me I am good at Mathematics' (social persuasion); 'Mathematics makes me confused' (physiological states).We reverse-coded some of the items on the scale so that a higher value corresponds to a higher self-efficacy. Regarding the school climate, we assessed the extent to which learners were eager to be in school and experienced support from the peers (positive school climates; PSC). Positive school climate items were reverse coded to ensure that a higher value reflected better school climate. School climate was also scored on a Likert-type scale ranging from *1 (Agree a lot) to 4 (Never or almost never)*. Long-term educational aspirations required learners to indicate the highest level of education they expected to attain on a scale ranging from *1 (Finish grade 9) to 8 (Complete doctoral degree)*. Scores on mathematics achievement were determined using a matrix-sampling approach to package the entire assessment pool of mathematics and science items into a set of 14 booklets by the International Association for Evaluation of Educational Achievement (IEA). Each learner completed only one booklet. To summarise the achievement results on a common scale with a mean of 500 and a standard deviation of 100, TIMSS 2015 used item response theory (IRT) method. The TIMSS IRT scaling approach used "plausible values" methodology to obtain achievement scores in mathematics for all learners. This was necessary as it was not feasible for each learner to answer every item, thus each learner responded to only a part of the assessment item pool. Plausible values are not intended to be estimates of individual student scores, but rather are imputed scores for students with similar response patterns and background characteristics in the sampled population—that may be used to estimate population characteristics correctly. However, the limitation is that they are generally biased estimates of the proficiencies of the individuals with whom they are associated and taking the average may of the plausible values will still not yield suitable estimates of individual student scores (Martin et al., 2016).

Data analysis

Analysis of the data was performed using the Statistical Package for Social Sciences (SPSS) and Mplus software (Muthén & Muthén, 2015). We took two steps to determine whether the observed data fit the sample. First, we ran a measurement model to determine the extent to which the indicators of each latent variable loaded strongly on their respective latent variables. We did not test a measurement model for school resources and learner aspirations as these were not latent variables measuring an underlying construct. In addition, an index score had been created for these variables in the TIMSS dataset. Mathematics achievement was treated as an estimate (average of plausible values) on performance scores on mathematics. The indicators for each of the above-mentioned variables (self-efficacy and positive school climate) were used to create latent variables to depict relationships across the variables. After testing the measurement model, we estimated a structural model comprising self-efficacy, school resources, school climate, learner educational aspirations and achievement. Mathematics achievement served as the outcome variable. We also tested a mediated model through learner educational aspirations. A mediated model seeks to identify and explain the mechanism that underlies an observed relationship between the dependent variable (achievement) and the independent variables (self-efficacy, school climate and school resources) through a third variable (learner aspirations).

The criteria for determining if a model has good fit indices is determined by the following cut-off points: Comparative Fit Index (CFI) = >.90, Tucker-Lewis Index (TLI) = >.90, Root Mean Square Approximation (RMSEA) = < .08, Standardised Root Mean Square (SRMR) = <.08. These fit indices determine the extent to which the model tested fits well with the data. We did not report on the chi square due to its sensitivity to sample size (Satorra & Bentler, 2001). The significance of pathways was judged on the basis of their standardised regression coefficients (b) having a probability value of below .05 and a 95% confidence interval (CI) which excluded zero

Results

Correlations and summary of means

Table 1 sets out the means and standard deviations of the variables and constructed indices. We found moderate to significant positive correlations between mathematics achievement and learner aspiration, self-efficacy, school resources and positive school climate. Learner educational aspiration was also found to be related to self-efficacy, school resources and positive school climate (see Table 1). We found that self-efficacy, positive school climate and school resources had Cronbach alphas of .80, .73 and .84, respectively.

Table 1: Summary of correlations, means and standard deviation

	MA	LA	SE	SR	PSC
MA	1				
LA	.42**	1			
SE	.28**	.13**	1		
SR	.24**	.02*	.02	1	
PSC	.04**	.09**	.19**	.16	1
Means (SD)	370.22 (77.5)	5.65 (2.4)	9.8 (1.8)	9.3 (1.4)	10.6 (1.9)

*Note: ** correlation significant at P < .01, MA = Mathematics Achievement, LA = Learner Educational Aspirations, SE = Self-efficacy, SR = School Resources, PSC = Positive School Climate*

Measurement model.

We tested two measurement models for self-efficacy and positive school climate. Preliminary exploratory factor analyses showed that self-efficacy comprises two factors. One dimension pointed to ability to do mathematics (called positive self-efficacy) and the other difficulty in mastering mathematics (called reservation self-efficacy). Items on ability to do mathematics included "*I usually do well in mathematics*" and for difficulty, "*mathematics makes me nervous*". We therefore tested a bi-dimensional model for self-efficacy and findings showed that CFI = .986; TLI = .981; RMSEA = .032 [90% CI: .029, .035]; SRMR = .020 with significant factor loadings for observed variables on their hypothesised latent factor. We also performed a CFA on positive school climate testing a unidimensional model and our results indicated a good model fit as demonstrated by the following indices CFI = .979; TLI = .969; RMSEA = .031 [90% CI: .028, .036]; SRMR = .018. There were significant factor loadings for each of the items.

Structural model

We tested a mediated model between self-efficacy, school resources, school climate, learner aspiration and mathematics achievement. The model fit indices showed that the hypothesised model with pathways to mathematics achievement fit the data. Our findings indicated that CFI = .954; TLI = .944; RMSEA = .039 [90% CI: .038, .040]; SRMR = .050. We hypothesised that learner aspiration will mediate the relationship between the other variables and mathematics achievement. We also hypothesised direct relationships between self-efficacy, school resources, school climate and learner aspiration as well as mathematics achievement. In addition, we hypothesised a direct relationship between learner educational aspiration and mathematics achievement.

Direct relationships

A direct effects model was tested to explore the effect of self-efficacy, positive school climate, school resources, learner educational aspirations on mathematics achievement as well as the direct relationship between learner educational aspirations and achievement. There was a significant positive relationship between positive self-

efficacy b = .09, [95% CI: .06, .11], p< .001 and mathematics achievement but not reservation self-efficacy. However, this relationship was approaching significance at P =.09. Contrary to the hypothesised relationship, positive school climate was negatively related to mathematics achievement b = -.07, [95% CI: -.01, .05], p < .001. Mathematics achievement was found to be significantly negatively related to school resources b = -.17, [95% CI: -.19, -.16], p < .001 and positively with learner aspiration b = .07, [95% CI: .05, .1], p < .001.

Positive self-efficacy predicted learner aspiration, although a negative relationship b = -.14, [95% CI: -.21, -.06], p < .001 and positive school climate was found to be significantly positively related to learner aspirations b = .31, [95% CI: .25, .37], p > .001. However, the hypothesised relationship between learner aspiration and school resources was not significant.

Mediated relationships

The indirect relationship between positive self-efficacy and mathematics achievement was found to be significant b = -.01, [95% CI: -.02, -.00], p < .01 (see figure 1) but not the indirect relationship between reservation self-efficacy and mathematics achievement. Similarly, the relationship between school resources and mathematics achievement as mediated by learner aspiration was not significant. As expected there was a significant mediated path from positive school climate to mathematics achievement via learner aspiration b = .02, [95% CI: 01, .03], p < .001. In summary, of the hypothesised mediated paths, positive self-efficacy and positive school climate were found to be significant.

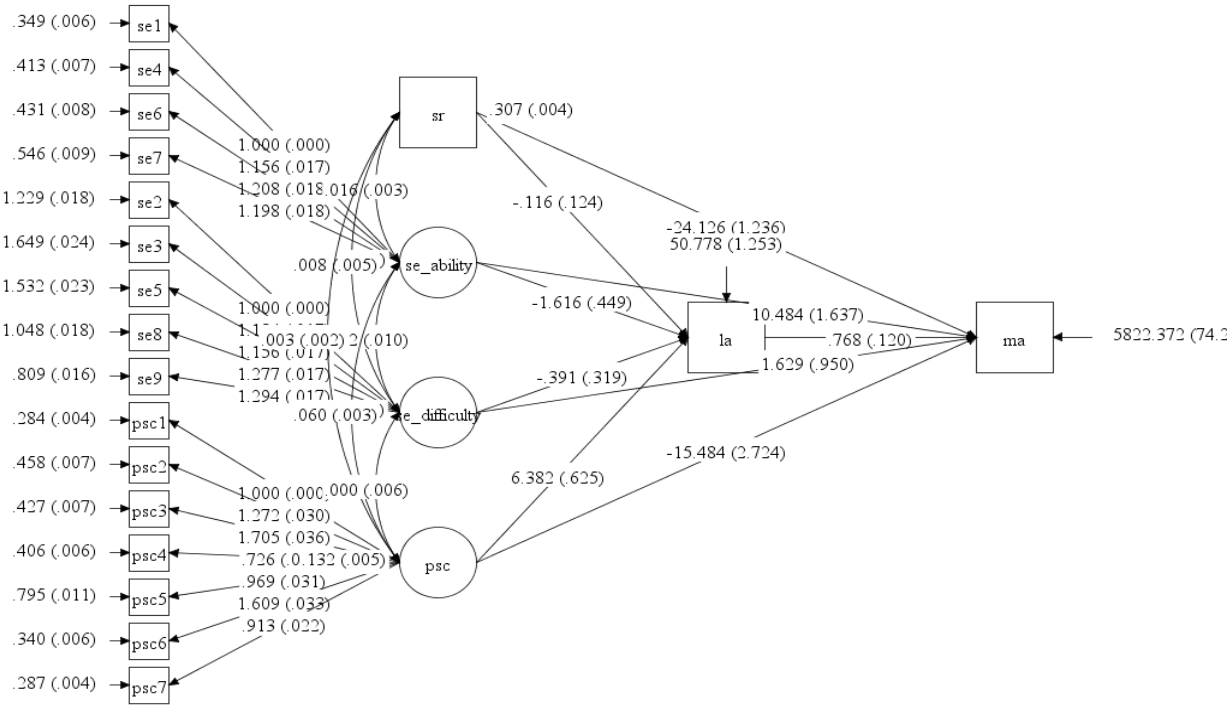

Figure 1: Hypothesised mediated structural model

MA = Mathematics Achievement, LA = Learner Educational Aspirations, SE = Self-efficacy, SE_ability = Positive self-efficacy, SE_difficulty = Reservation self efficacy, SR = School Resources, PSC = Positive School Climate

Discussion

The aim of present study was to test the hypothesised mediated relationship between self-efficacy, school resources, positive school climate, learner educational aspirations and mathematics achievement. Learner aspirations was indicated as the mediator of the predictor variables and mathematics achievement. First, we tested two measurement models: self-efficacy and positive school climate. Our findings showed a two-dimensional model as being the best fit for self-efficacy and a uni-dimensional model for positive school climate. We then tested a structural model demonstrating direct and indirect relationships between self-efficacy, school resources, positive school climate, learner aspirations and mathematics achievement and our model fit indices indicated a good fit with the data. This implies that mathematics achievement among our sample of South African Grade 9 leaners, is predicted by relationships across self-efficacy, school resources, positive school climate being mediated the level of learners' educational aspirations.

The findings of our study in line with previous literature showed that positive self-efficacy and learner aspiration were significantly positively related to mathematics achievement. Studies in different contexts have indicated that self-efficacy for mathematics has the potential of improving academic outcomes (Grigg, Perera, McIlveen, & Svetleff, 2018; Kung & Lee, 2016). Underlying this relationship is the theoretical assumption that self-efficacy presents itself as a unique human capability that influences motivation and effort expended on activities and perseverance in confronting challenges. Beliefs in the ability to perform well in mathematics tasks seem to influence motivation and efforts invested in order to improve performance.

Another positive relationship that emerged in our study was the link between learner educational aspiration and mathematics achievement. This finding was not surprising as we expected that when learners set high educational aspirations, they would be motivated to improve their academic performance. Previous studies have demonstrated that aspirations provide the motivation to improve achievement (Harder, 2015; Hynds et al., 2017). Ahuja (2016) found a positive correlation between educational aspirations and achievement among Indian learners. The authors argued that non-cognitive factors like motivation is important for enhancing achievement in academic domains.

The hypothesised relationship between school resources and mathematics achievement was found to be significant. The index for school resources measured the extent to which shortage of resources affected the school's capacity to provide instruction with higher scores indicating that the schools' instructional capacity were less affected. This would imply that when instructional capacity was less affected, mathematics achievement would increase, thereby explaining the observed negative relationship with achievement. The observed relationship with mathematics achievement supports earlier research in South Africa, arguing that, school resources do predict educational outcomes (Spaull, 2012, 2013). This is because wealthier and more resourced schools tend to be more functional as a result of their ability to attract more qualified teachers with higher qualifications. The presence of adequate instructional materials also facilitates learning and stimulates cognitive functioning.

In line with our expectation, positive school climate emerged as being positively related to education aspirations. This is could be due to positive psychological effect of social interaction and the sense of belonging that allow learners to aspire to greater levels of achievement. Research on school climate has been influenced by the social cognitive theory and ecological model, highlighting that different transactional processes occurring at multiple levels influence behaviour (Bandura, 1986; Bronfebrenner, 1994). In line with this reasoning, Lindstrom Johnson, Pas, and Bradshaw (2016), found that school climate in terms of the values and attitudes that shape interactions between learners and teachers have the capacity to set future orientations, one of which would be educational aspirations. In a study by Cornell and Huang (2016) authoritative school climate characterised by a disciplinary structure and student support resulted in higher educational aspirations.

An unexpected finding was the negative relationship between mathematics achievement and positive school climate. Our findings showed that the experience of a sense of belonging and supportive relationships may have a detrimental relationship with achievement. This finding has not been supported by previous research. Both Khattab (2015) and Hynds et al. (2017) put forward that the types of social interactions between teachers and

peers improve achievement. The place-based and contextualised nature of achievement makes school climate an important predictor. However, the observed negative relationship might imply that some kinds of school relationship could lead to complacency, which in turn negatively predicts mathematics achievement. This finding requires further exploration. It is also possible that social desirability bias that is linked to self-report measures might have tainted perceptions of school climate.

Another unexpected finding was the negative relationship between positive self-efficacy and learner aspiration. It was expected that the more positive self-beliefs a learner has about their abilities, the greater the aspirations they will set for themselves. It is possible that learners with positive self-beliefs of their abilities are more careful in setting highly unrealistic educational aspirations. It is possible that the data shows that learners are more circumspect about evaluating their ability but have set very high educational aspirations. It is important to point out that compared to more developed economies, South African learners were more likely to set high aspirations that do not take into cognisance their position of disadvantage and economic deprivation (Zuze, Reddy, Visser, Winnaar, & Govender, 2017). These unrealistic aspirations might explain why there is a negative relationship with perceived actual abilities to perform well. However, further research is needed to elucidate this unexpected result.

The mediated path from positive self-efficacy with mathematics achievement through learner aspiration was significant. This implies that in order to improve mathematics achievement among South African learners in Grade 9, considerations need to be given to both positive self-efficacy and learner aspiration. To our knowledge, this is the first study using a representative sample of Grade 9 learners in South Africa to determine the mediating effect of learner aspiration on mathematics achievement. The unexpected negative relationship between positive self-efficacy and learner aspiration shows that accurate assessment of self-efficacy regarding ability to do mathematics, allow participants to set realistic or low educational aspirations that in turn could predict achievement. The realistic aspirations combined with high self-efficacy results in learners investing the necessary effort in order to excel in mathematics. Our findings also point to the importance of tempering aspirations so that learners recognise the importance of effort in order to achieve better results.

The positive mediated relationship between positive school climate and mathematics achievement shows that increased experiences of a sense of belonging at school is likely to enable learners aspire to go far with their education which in turn motivates them to invest efforts to improve their academic achievement. In line with previous studies testing the direct relationships between school climate and learner aspiration; and between learner aspiration and mathematics achievement, the findings of the present study point to the importance of context in intervening in both cognitive (achievement) and non-cognitive (aspirations) aspects of the life of learners. Our findings also imply that non-cognitive factors as argued by Fortin et al. (2015) provide the space for learners to execute cognitive strategies, which may improve performance. Implications of these findings are discussed.

Conclusions and limitations of the study

An important contribution of the study is the need to explore broader array for predictors simultaneously when attempting to improve performance in mathematics. On educational interventions, practitioners need to consider the extent to which school climates do influence learners to aspire to higher educational levels. School climates must not only be conducive but in deprived contexts, there is a need for optimal utilisation of resources in order maximise aspirations. Psychological interventions need to target the learner aspiration by adopting strategies that improve a sense of belonging in the school context. In addition, the relationship between self-efficacy and mathematics achievement point to the possibility of interventions in schools that target enhancing learners 'feeling of efficacy. These interventions must be adequately channelled to learners' beliefs about how far they can go in their educational pursuits.

Although the study utilised a large nationally representative dataset with a strong statistical analytic tool for estimating relationships, no inferences can be made about the causal nature of the relationships. However, it is worth noting that previous studies from earlier TIMSS studies support some of our findings on the predictors

of mathematics achievement. Future studies can go step further in following the same set of learners overtime in order to determine the causal nature of the hypothesised relationship.

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