

Chronicling the experiences and beliefs of mathematics student teachers and their educators on their practices

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ABSTRACT

Understanding the experiences of those undergoing teacher education and their educators is central to pedagogical practices. While some studies have found that experiences and beliefs influence instructional decisions, others revealed that practice influences beliefs. Although the complexity of the relationship between conceptions and practice defies the simplicity of cause and effect, much of the contrast in the teachers' instructional emphasis may be explained by differences in their prevailing views of mathematics. This study examined the experiences and beliefs of mathematics student teachers and their teacher educators on their practices. The study employed a qualitative research approach and a case study design; data was gathered using document reviews, observations, and interviews. For this study, seventy-five mathematics student teachers and six mathematics teacher educators were purposively sampled from three traditional South African universities. Data collected for this study were analyzed thematically. Research findings revealed that teacher education program positively influences mathematics student teachers' beliefs of their practices. On the contrary, mathematics teacher educators' educational background and teaching experiences contribute little to no to their teaching, making their practices authoritative. The study concludes that the emotional, relational, and moral viability of pedagogical methods is dependent on the experiences of those undergoing mathematics teacher preparation programs and their educators. As a result, development programs for mathematics teacher educators are critical for upskilling them in how to set up and manage more participatory classrooms.

INTRODUCTION

Most engineers and scientists would liken mathematics to a tree bearing the fruits of knowledge (theorems, results, and formulas), which are accessible to anyone who reaches up and plucks the fruit (Roussouw, Rhodes & Christiansen, 2009; Olawale, 2021). Mathematicians, by contrast, see their field as a rainforest, which is rapidly growing, shaped, and nourished by powers outside mathematics, to help contribute to human civilization in all diversity (Dossey, 1992, p. 39). One aspect that has gained significant attention over the years is teachers' subject knowledge in shaping practice (Shulman, 1986; Oleson & Hora, 2014; Deng, 2018). Roussouw et al. (2009), as well as Groth (2013), describe mathematics teachers' subject knowledge as consisting of ideas, frameworks, and theories; therefore any learning opportunities in the classroom will be dependent on each teacher's view of what mathematics is all about.

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Many people would agree that learners' growth and learning depend on the quality of their teachers. For that reason, all parents want their children to be taught by experienced teachers (Ingersoll et al., 2014). Several studies have identified a strong link between teacher education and the quality of their teaching and learning (Robinson & Macmillan, 2006; Snoek et al., 2010; Miles et al., 2016). Studies have also reported that learners learn better from experienced teachers, which means the role of a teacher is not solely to pass on information to learners; but also about facilitating, educating and engaging them in meaningful discussion (Kosnik et al., 2015). Thus, teacher preparation is a vital element in the education process (Bates et al., 2011; Olawale, 2021b).

However, studies into the experiences of in-/pre-service teachers, and the impact which teacher education programmes have on their practice, are rare. The previous studies have revealed contradictory results: the first is that teacher training programmes have little impact on teachers' beliefs (Alfaro & Joutsenlahti, 2020; Peker & Ulu, 2018; Dede & Karakus, 2014); the second is that teacher training programmes do sway pre-service teachers' beliefs (Doruk & Kaplan, 2012; Rosas & West, 2012). For instance, Dede and Karakus (2014) investigated the effects of teacher training programmes on pre-service mathematics teachers' beliefs about mathematics. Their study used a sample of 173 participants from the Faculty of Education at a university in the Central Anatolia Region of Turkey. The findings of the study revealed that pre-service teachers' beliefs were affected by their teacher training programme, but that the programme was not sufficient to change their beliefs. Berger et al. (2018) argue that in any teacher education programme, the experiences and beliefs of teachers play a marked role. This is because student teachers' learning outcomes are related to their beliefs and attitudes about mathematics, and these outcomes are influenced by their experiences.

Rosas and West (2011) investigated pre-service teachers' perceptions of their readiness to teach mathematical concepts as well as their ability to integrate mathematical themes into their lessons. Pre-service teachers who attended a private teacher education program and those who attended a public version of the same were compared. Both groups of participants felt prepared to teach mathematics, according to the findings. In addition, the groups' views of their abilities to integrate mathematical concepts into their teaching were very identical. As a result, Doruk and Kaplan (2012) submit that teacher education programs have the potential to impact pre-service teachers' ideas and experiences. In addition, Berger et al. (2018) concur, noting that pre-service teachers' beliefs, experiences, and attitudes have the potential to affect their interaction and possibly their pedagogical practices.

It is therefore worth noting that classroom practices and effective management is also an important topic in teacher education, as what happens in class has a strong impact on learners' engagement. Berger et al. (2018) state that teachers' experiences, beliefs, and teaching practices should intersect in a meaningful way, and with other teaching tasks such as assessments. Berger et al. (2018) investigated the associations between classroom management practices, teaching experience, and teachers' beliefs (general pedagogical beliefs, beliefs about learner motivation, and self-efficacy beliefs). Data for the Berger study were generated from 154 vocational teachers in teacher education, and they concluded that there was a strong relationship between teachers' beliefs and practices and the types of beliefs they held. Thus, teaching experience was positively related to teachers' beliefs and self-efficacy but did not have any impact on their practice.

Consequently, the field of teaching and teacher education has long documented the potential impact of teachers' beliefs, experiences, and attitudes on their interactions with learners as well as their pedagogical practices (Pettit, 2011; Molle, 2013; Farrell & Ives, 2015). However, reforms in terms of educators' roles in building students' social competences have recently risen to the forefront

of global higher education policy debate (Hénard & Roseveare, 2012). The envisaged reforms propose shifting teaching practice away from traditional and authoritative methods to learner-centred pedagogical approaches, which facilitate learners' social learning (Hénard & Roseveare, 2012; Olawale, 2021b). The quality of teacher training has become a contentious issue as it affects research, reform, and policy (Ingersoll et al., 2014).

Notwithstanding, some studies reported that teacher educators remain an under-researched, poorly understood and ill-defined occupational group (Murray, 2016; Patton & Parker, 2017). This is why Kosnik et al. (2015) advocate studying teacher educators' identities, experiences, practices, histories, transitions, problems, individual skills, and circumstances in order to capture the complexity of their work. To date, the majority of studies on teacher educators and pre-service teachers' experiences and beliefs about mathematics, as formed during teacher preparation programmes, focused on academic performance, attrition rates, self-efficacy, mathematics anxiety, technology self-efficacy, teaching and learning strategies, beliefs about nature, experiences during teaching practices, and the like (Bhargava & Pathy, 2011; Getenet, 2013; Kulshrestha & Pandey, 2013; Doruk, 2014; Ingersoll, Merrill, & May, 2014; Başpınar & Peker, 2016; Kent & Giles, 2017; Afyonkarahisar & Kutahya, 2018).

While teacher professional development has been extensively researched (Darling-Hammond, 2010; Shapira-Lishchinsky, 2016), few or less is known about teacher educators' professional development (Skott, et al., 2018; Patton & Parker, 2017). This explains the motivation for undertaking the present study. According to Bates et al. (2011), teacher educators' professional development is a topic of interest and of concern. Kosnik et al. (2015, p. 217) make a strong case for discipline-specific research involving teacher educators, arguing that their work is varied and that more studies are needed "to capture the complexity of their work by examining their identities, experiences, practices, backgrounds, transition, challenges, individual talents, and contexts".

Although studies such as that of (Skott et al. 2018; Patton & Parker's, 2017; Kent & Giles, 2017) amongst many others specifically focus on how factors such as experiences and beliefs of pre-service mathematics teachers within the teacher education programme affect their teaching practices. These studies also focus on the complexities and contradictions in teacher education programmes', and how pre-service teachers' backgrounds affect their practices (Skott et al. 2018; Patton & Parker's, 2017; Kent & Giles, 2017). However, the majority of these studies do not consider how teacher educators' educational background and their experiences influence their practices during the programme. As such, this study intended to fill this gap by focusing on both the pre-service teacher and mathematics teacher educators' within the same context. The study also uses qualitative research, which is different from the method (quantitative) other related studies employed in order to gain a better understanding of how teacher education programme influences teachers' practices and beliefs about teaching and learning mathematics. These findings are expected to contribute to the growing field of teacher education by providing a better understanding of how teaching programmes influences teachers' enacted practices and beliefs about mathematics teaching and learning.

METHODS

This study aims to provide a deeper understanding of how teacher education programmes influences teachers' enacted practices about mathematics teaching and learning. The study group of the research consists of seventy-five (75) mathematics education student teachers who were undertaking teacher training in the Faculty of Education at three different traditional universities in Eastern Cape Province, South Africa. At each of the three universities, purposive sampling technique

was used to select two (N=2) mathematics teacher educators who have been on the job for more than a decade. These teacher educators were selected with the expectation that they would report unique and interesting data with regard to their educational background and experiences in the teacher education programmes and how it influences their practices. Purposive sampling technique was then used to identify 25 (N=25) second- to fourth-year mathematics education student teachers who were undertaking teacher training. These samples were chosen because they would be best suited to provide information about their own experiences during the programme.

Data collection tools

To 'get inside' the processes and relationships of teacher education and understand the experiences and beliefs of mathematics teacher educators and student teachers, interviews, observations, and document reviews was employed as data collection technique. During the data-collection process, 25 mathematics education student teachers were interviewed, one-on-one, at each university. Each in-depth interview lasted approximately 30–45 minutes, and it was framed by informal conversation, and audiotaped. For this study, the semi-structured interviews were used to compare information while allowing sufficient flexibility for the individual flow and character of each encounter. This type of interview gave participants ample opportunity to express themselves, but more attention was focused on the set questions, to avoid aimless rambling (Datko, 2015).

During observation, the participants attended lectures and the author(s) took notes of the practices unfolding in the venue, using the observation schedule. Each mathematics educator was observed during his/her lecture period. Creswell and Creswell (2018) affirms that an observation protocol assists the researcher with the proper documentation of information. As such, the author(s) focused on the teaching approaches, interactions between the educator and student teachers, the nature of the relationship between the educators and students, and amongst the students themselves, or even amongst the educators. Non-verbal behaviours were also observed, such as participants' gestures or expressions when responding to questions/comments.

A review of documents was employed as the third data-collection tool to support/validate the experiences and beliefs of mathematics student teachers and their teacher educators on their practices. Fitzgerald, Hackling, and Dawson (2013) posits that documents assist researchers in exposing aspects of the research that might not be revealed when using other sources of data collection. Thus, for this study, written official documents (such as the institutional teaching and learning policy) were integrated to corroborate and balance the research findings from both the interviews and the observations. This served to improve the trustworthiness of the research findings. In cases where evidence was conflicting, the researcher resolved the problem by digging deeper into the topic.

Data collection and analysis

During the data collection process, permission was obtained from the ethics committee of the three universities who participated in the study. All participants were given details of the proposed study prior to participating and had an opportunity to grant informed consent beforehand. Permission to observe the lectures was sought from the course coordinators, heads of department, the university authorities and all the pre-service student teachers – including those who chose not to participate in the study. Consent forms were handed to all the sampled participants to complete, without coercion. The consent forms addressed the aims and purpose of the study, the likely publication of the findings, as well as issues of confidentiality and the benefits, risks, dangers (if any) associated with their participation in the research endeavour. Then, before proceeding to the analysis process, all data collected was categorized based on the emerging themes and transferred

to the computer for analysis. Thereafter, the data was thematically analyzed using Marshall and Rossman's (1999) analytical technique, which includes six steps starting from the organization of data, to the creation of categories, themes, and patterns. This was followed by coding the data; thereafter, the author(s) tested the emergent understanding, sought an alternative explanation, and finally presented the report.

During data organization, information gathered from interviews were transcribed word for word and typed neatly in a Word document. After their proper organisation, the data were read meticulously to identify the emerging themes. Once the data had been closely read, the researcher(s) assigned codes to all the participants and the findings respectively. Folders were opened for each category of participant, e.g., mathematics educators and mathematics student teachers. In the third step, the researcher(s) created a separate Word document to store the data gathered in the form of a table, which accommodated the different responses of the participants, based on their categories. Codes, names and colours were assigned to the responses for a systematic handling of the information. Thereafter, the researcher(s) tested the emergent understandings – at this stage, the researcher(s) used colours to code content based on the sub-headings generated. Code names were written next to the text. During the fifth step, the researcher(s) endeavoured to make sense of the responses through various explanations, and thereafter wrote the report with much attempt to minimise the authorial voice but focusing on creating an objective account of meaning as provided by the participants.

To ensure validity of the research findings, attention was given to triangulation by using multiple data-collection techniques. As a result, the research findings were compared to check for similarities between the sources of data collection, to strengthen the validity of the study. Also, for the purpose of this study, data trustworthiness was ascertained through prolonged engagement at the research site which allowed the researcher(s) to acquire in-depth and ample information regarding the phenomenon under study, thereby enhancing the study's credibility.

FINDINGS AND DISCUSSION

The present study examined the experiences and beliefs of teacher educators and pre-service teachers on their practices in mathematics teacher education programmer. The three higher education institutions visited for this study were given pseudonyms such as University X, University Y, and University Z to distinguish them. The information gathered during the interviews is presented in connection to the interview questions and the verbatim utterances provided by individuals connected with those universities. This was done to have a comprehensive picture of the responses of the participants. [Table 1](#) shows the codes representing the respective participants. As such, results and discussions were presented under the following sub-heading:

- Mathematics student teachers' experiences and beliefs on their teaching practices.
- Mathematics teacher educators' background and experiences on their teaching practices.

Mathematics student teachers' experiences and beliefs on their teaching practices

To elicit information on how mathematics student teachers' experiences during the teacher training programme is capable of impacting their practices, participants were asked: 'How do you think the teacher preparation programme and your experiences as a pre-service mathematics teacher will impact your practices?' The research findings suggest that students' experiences of the teacher education programme are central to the development of emotional, relational, and decent, sound pedagogical practices. Also, the participants referred to how their experiences during the

teacher training programme affected their personal lives. For instance, a mathematics student

Table 1
Codes representing participants

Participants	Codes
Mathematics teacher educators in University X	ME1 & 2; University X
Mathematics teacher educators in University Y	ME1 & 2; University Y
Mathematics teacher educators in University Z	ME1 & 2; University Z
Mathematics student teachers in University X	ST1–25; University X
Mathematics student teachers in University Y	ST1–25; University Y
Mathematics student teachers in University Z	ST1–25; University Z

teacher remarked:

... the experience that I've gained so far has helped me a lot. For example, during a module which involves [the] education curriculum, we were sent to schools for school-based learning activity, which enhance[d] my teaching ability and skills as a teacher. So, this experience also has helped me to be more organised as a teacher and [...] when I start teaching, it will help me with classroom management. (ST4; University Y)

On the benefits of the programme, another participant stated:

... during this programme I have learnt about teacher resilience, that is, what it takes to be a good teacher and how to manage my class. I have also learnt that teachers can act as inventors, parent[s] and as friends to their learners. So, this makes me realise that it is my responsibility to take care of my learners. So, when I start teaching, it is my duty to make sure I create a safe space for my learners. (ST3; University Z)

One student teacher stated that his experiences of the teacher education programme would help him assist learners from disadvantaged backgrounds:

This teacher education programme assisted me with different methods that can be used in teaching and learning, which [are] capable of accommodating different learners regardless of their needs. [...] So, as a black South African mathematics teacher who will probably be teaching at rural schools where there are no teaching and learning resources, laboratories and the like, [...] from my experience, I am well-grounded on how to assist learners by improvising [such] resources [as] will facilitate their learning. So, in schools where there are no teaching and learning resources, I can come up with innovative teaching methods and ideas to assist the learners. (ST11; University Y)

That study participant became emotional when talking about the challenges faced at disadvantaged schools which he had attended. He added:

I went to a school where we were only Xhosas. So, 2018 was my first time to be in such a big multiracial and multicultural environment like this university. So far, I've learnt a lot on how to act around multiracial situations and to accommodate different people around me. Therefore, when I start teaching, I [will] already know how to accommodate my learners and engage them in classroom discussions regardless of their race and background (ST11; University Y)

Another participant noted how the teacher education programme enlightened mathematics student teachers about accommodating learners during their own practice, stating:

We are trained to use different kinds of learning styles and methods such as group work and discussion method which involves grouping learners so that they can be well accommodated. So, for example, those learners who don't understand the teacher or who feel shy to contribute in class, they will be able to talk in their groups, and their peers can [...] pass information to them. Also, there's this other thing called the language barrier. So here at our institution we are trained to use the language that best accommodate[s]

the learners, by not only focusing on English as a teaching language but we are encouraged to use [an] African language if they don't understand English. So, for my mathematics learners, I can as well use my local language to explain the mathematics terms or exercise, when and where possible. (ST4; University X)

It is evident, judging from the participants' responses, that their experiences during the teacher education programme instilled in them democratic values such as respect, tolerance and a willingness to encourage active participation. The idea of respecting learners' views as a way of curbing violent behaviour was proposed by one participant:

My experience during the teacher training programme and through my methods taught me how to shift learning from teacher-centered to learner-centered, in order to allow learners to express their views. I am also aware now that I must learn to respect and tolerate my learners because this opportunity will help them to be less violent. So, my experiences will impact on my practices in a positive way. (ST1; University Z)

This comment, along with the preceding remarks, suggests that teacher education programmes have, and will continue to have, a positive influence on the belief of student teachers' practices in class. The findings also revealed that amongst the experiences garnered by participants are the exhibition of democratic principles within the classroom and the use of different instructional approaches capable of accommodating different learners with diverse learning abilities. This research finding corroborates the work of Dede and Karakus (2014), who investigated the effects of teacher training programmes on pre-service mathematics teachers' beliefs about teaching their subject. Those researchers found that teacher education programmes affected the pre-service teachers' beliefs, to the extent of influencing their teaching practice (Dede & Karakus, 2014).

Patton and Parker (2017) posit that teachers' experiences and beliefs play a significant role in the teaching and learning of mathematics. This is because there is an interconnecting relationship between learner learning outcomes and teachers' attitudes and beliefs about the subject, and for this reason, assessing learners' knowledge of mathematics must be done in the context of their beliefs (Patton & Parker, 2017). During the researcher's interview sessions at the research sites, further probing went into finding out whether the teacher education programme might/might not negatively affect their teaching practice. One participant responded and narrated her beliefs:

Well, for me... there's no way you will be here for four years, going for school experiences and some other academic activities outside and within the university, that the experiences gathered won't help you improve your teaching practices positively. (ST10; University Y)

The above response was echoed by the majority of the participants at the other research sites. It appears to confirm that mathematics student teachers' belief about the teacher education programme and their experiences will have a noticeable effect on their classroom practice. Molle (2013) and Farrell and Ives (2015) concur, adding that a teacher's beliefs, experiences, and attitudes have a potential impact on their interaction with learners and also influence their pedagogical practices. It is thus vital for any teacher education programme to focus on shifting teaching and learning practices away from authoritative and traditional lecture-style teaching (historically associated with higher education teaching) toward learner-centered pedagogical approaches (Hénard & Roseveare, 2012).

Mathematics teacher educators' background and experiences on their teaching practices

Mathematics educators were asked, "How does your educational background and experiences affect your practices?". The research findings also revealed that mathematics educators' educational background and teaching experiences make little or no contribution to their practice, nor do these

factors have the positive effect of upholding democratic principles within their mathematics education classrooms. As one mathematics educator admitted:

A lot of what I learnt during my teacher training days was imposed on me. For example, there are no instances where teachers ask[ed] students about their views or how the curriculum should be structured. So, there is no major contribution it has on my practices, but based on my teaching experiences over the years, I find a way to reorient myself and accommodate my learners, and I always look out for professional development programme opportunities within and outside the university. (ME1; University Z)

Another mathematics educator commented:

... having been in the programme for a number of years, I'm in a position to reflect and begin to identify some situations where there was some kind of injustice in the practice, that is, the teacher education programme I went through. And so, it was a question of re-schooling myself as an individual who has been trained through a less democratic approach. I had to re-school myself and begin to attach a different value to the students, as human beings who should and must have a voice in the teaching and learning process. So being a mathematics educator made me [...] realise that there were some misgivings about mathematics, such as different beliefs, mathematics as a subject for the intelligent people and other mathematics-related anxiety. Hence, my teaching is targeted towards such [mistaken] beliefs. (ME2; University Y)

A participant at University X also explained the challenges faced in accommodating student teachers who want to live a democratic life and have a say in their learning process:

It is true that I went through a teacher education programme, but it was preparing me to teach in high schools. In fact, I specialise in secondary school teacher education programmes, so I was surprised to find myself teaching here at the university. When I was teaching in high school, I was teaching in such a way that learners are expected to listen and get all the information from me as a teacher, but the difference between the university student and the high school learner now, is that the university students are too independent! They want to be involved in everything! [...] Although I am not trained on how to handle independent students, [...] I am trying my best to accommodate them. (ME1; University X)

As reported, the teacher education programmes through which mathematics student teachers were being trained also had a negative impact on educators' practices. As such, educators lamented that their training had been less democratic and that it prevented them from demonstrating what it truly means to learn or teach in a democratic mathematics classroom. This finding concurs with that of Peker and Ulu (2018) who posit that, in both advanced and developing countries, teacher education programmes are considered to be representative of authoritarian institutions. Authoritarianism has gradually been transferred into institutions where teachers are being trained to teach (Agyemang, 2012). As Peker and Ulu (2018) argues, based on the consensus that exists between school experience, its structuring and the process of teacher education, these programmes fail to break the cycle of authoritarianism in schools. As UNESCO (2018) reports, schools that are run in an authoritarian manner will deprive learners of the chance to develop a democratic culture. In worst cases, this deprivation will lead learners to become cynical about the so-called democratic system in which democratic views are not reflected in similar actions.

Many mathematics educators recognise the need to democratise their teaching and learning methods in their classrooms and strive for a personal orientation which is democratic in nature. As the research findings suggest, what is needed is professional development which cultivates democratic mathematics classrooms. Peker and Ulu (2018) propose, even if student teachers' educational programmes and previous experiences in schools fail to prepare them to teach democratically, it is paramount for teacher educators to learn ways of working democratically in both

schools and classrooms. Skott et al. (2018) add that effective teacher professional development improves the pedagogical and content knowledge of teachers. It also provides teachers with sufficient resources and time to improve their practices, as well as offering opportunities to promote a mutual and collaborative exchange of ideas and resources (Skott et al., 2018). Thus, teacher professional development is an essential factor in making a schools-based education more productive (Yarema, 2015).

The researcher's observation of classroom practices revealed that mathematics educators gave students the freedom to participate in discussions, but, surprisingly, decision making or conclusions from student engagement were tailored towards what the educators felt was right or should be the outcome of such a discussion. This observation concurs with that of Alfaro and Joutsenlahti (2020) who states that children start their lives with special skills and a desire to learn. Unfortunately, the schooling system downplays and kills their creative, and inquisitive minds simply because schools emphasise reasonable answers based on teachers' predictions. These schools place more importance on the practices of teaching, testing, accepting, and rejecting which is what skott et al. (2018) refer to as the 'pedagogy of the oppressed'.

During visits to the mathematics educators' offices, the researcher used the opportunity to engage with their lesson notes and lesson plans and found that these did not outline or reflect any actions towards establishing democratic practices. However, the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa (2011–2015) (DHET, 2011) and the institutional teaching and learning policy (anonymised) advocate the promotion of intellectual inquiry and critical scholarship amongst students. As such, educators are encouraged to adopt a humanising pedagogical approach. This approach promotes intellectual inquiry and critical scholarship through scholarly deliberation, encouraging critical discourse and the expression of a multiplicity of opinions, philosophies, and experiences, to develop democratic citizens.

The body of findings gleaned from the interviews, observation and documents, revealed that the participating educators' educational backgrounds had a negative impact on their classroom practices. In order for teacher education programmes to break the cycle of authoritarian school practices, Harber (1997) recommends that teacher educators focus on cultivating democratic classrooms. In addition, Alfaro and Joutsenlahti (2020) and Subba (2014) make a compelling argument that educators need to develop an authentic experience in their subject areas. This will enable them to control disputes and offer activities capable of enhancing learning experiences in order to teach learners about democratic principles and social justice. Hence, there is a need for teacher professional development which emphasises clear and specific objectives and activities in the curriculum, in relation to civic education (Subba, 2014). Such objectives should also focus on real-life experiences, and practices that significantly enhance democratic school culture, and include extracurricular activities (Subba, 2014).

CONCLUSIONS

While classroom practices and effective management have been argued as essential elements of teacher education programmes, the findings of this study revealed that the programme had positively assisted pre-service teachers. This is because the programme has shaped their beliefs through the agency of democratic teaching practices. As such, one can conclude that the experiences and beliefs of pre-service mathematics student teachers in this study were found to have the potential of affecting their interaction and possibly their pedagogical practices. Regarding the mathematics teacher educators' responses, the research findings revealed that educators'

educational background and their experiences had a negative impact on their classroom practices. These findings were not good enough for developing emotional, relational, and morally sound pedagogical practices. This is because educators' experiences and educational backgrounds have a major role in influencing their classroom practices, especially in terms of cultivating a democratic space capable of developing democratic citizens. As such, development programmes for mathematics teacher educators, which aim to upskill them in setting up and managing more democratic classrooms, are imperative. However, this study was carried out with a specific number of mathematics teacher educators and mathematics student teachers'; the same study could be replicated with a larger sample of participants, as well as universities. In addition, this study focuses on experiences and beliefs of participants and its influence on their practices, other factors such as the type of institutions, the class size in which teacher education programmes takes place, and the professional seniority/development of mathematics educators can also be examined.

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BIBLIOGRAPHY

- Afyonkarahisar, A., & Kutahya, D. (2018). The effect of pre-service mathematics teachers' beliefs about mathematics teaching-learning on their mathematics teaching anxiety. *International Journal of Instruction*, 11(3), 249-264. <https://doi.org/10.12973/iji.2018.11318a>
- Agyemang, B. (2012). Democratic education for social improvement: An exploration of the views of pupils and teacher trainees in Ghana. Unpublished PhD thesis submitted to the School of Education, University of Birmingham. <https://etheses.bham.ac.uk/id/eprint/4147/1/Agyemang13PhD>
- Alfaro, H.; Joutsenlahti, J. (2020). what skills and knowledge do university mathematics teacher education programs give future teachers in Costa Rica? *Eur. J. Sci. Math. Educ.*,8 (1),145-162. <https://doi.org/10.30935/scimath/9553>
- Apple, M. (2001). Markets, standards, teaching, and teacher education. *Journal of Teacher Education*, 52(3), 182-196. <https://doi.org/10.1177/0022487101052003002>
- Başpınar, K., & Peker, M. (2016). The relationship between pre-service primary school teachers' mathematics teaching anxiety and their beliefs about teaching and learning mathematics. *Journal of Theoretical Educational Science*, 9(1), 1-14. <https://doi.org/10.5578/keg.10628>
- Bates, T., Swennen, A., & Jones, K. (2011). The professional development of teacher educators. . London: Routledge. <https://www.tandfonline.com/doi/abs/10.1080/19415250903457653>
- Berger, J. L., Girardet, C., Vaudroz, C., & Crahay, M. (2018). Teaching experience, teachers' beliefs, and self-reported classroom management practices: A coherent network. *Sage Open*, 8(1), 1-12. <https://doi.org/10.1177/2158244017754119>
- Bhargava, A., & Pathy, M. (2011). Perception of student teachers about teaching competencies. *American International Journal of Contemporary Research*, 1(1), 77-81. https://www.aijcrnet.com/journals/Vol.1_No.1_July_2011/10
- Creswell, J. W., & Creswell, J. D. (2018). Research design: qualitative, quantitative, and mixed methods approaches (Fifth edition ed.). Los Angeles: SAGE. https://spada.uns.ac.id/pluginfile.php/510378/mod_resource/content/1/creswell
- Darling-Hammond, L. (2010). Teacher education and the American future. *Journal of Teacher Education*, 61(1/2), 35-47. <https://doi.org/10.1177/0022487109348024>
- Datko, J. (2015). On research methodology: Semi-structured interview in language pedagogy research. *Journal of Language and Cultural Education*, 3(2), 142-156. <https://www.researchgate.net/publication/279195544>

- Davies, L., Harber, C., & Schweisfurth, M. (2002). Democracy through teacher education: A guide book for use with student teachers. Birmingham: CIER. <https://eprints.gla.ac.uk/74789/>
- Dede, Y., & Karakus, F. (2014). The effect of teacher training programs on pre-service mathematics teachers' beliefs towards mathematics. *Educational Sciences: Theory & Practice*, 14(2), 804-809. <https://doi.org/10.12738/estp.2014.2.1787>
- Deng, Z. (2018). Pedagogical content knowledge reconceived: Bringing curriculum thinking into the conversation on teachers' content knowledge. *Teaching and Teacher Education*, 72, 155-164. <https://doi.org/10.1016/j.tate.2017.11.021>
- Department of Higher Education and Training (DHET) (2011). Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011-2025. Pretoria: Government Printer. https://www.sace.org.za/assets/documents/uploads/sace_58701-2016-08-31
- Doruk, K. (2014). The educational approaches of Turkish preservice elementary mathematics teachers in their first teaching practices. *Australian Journal of Teacher Education*, 29(10), 113-134. <https://ro.ecu.edu.au/cgi/viewcontent.cgi?article=2374&context=ajte>
- Doruk, M., & Kaplan, A. (2012). Sınıf öğretmeni adaylarının matematik öğretimine yönelik öz-yeterlik inançlarının incelenmesi [Examination of the teachers' self-efficacy beliefs about mathematics teaching]. *Journal of Academic Social Science Studies*, 5(7), 291-302. https://jasstudies.com/?mod=makale_tr_ozet&makale_id=26256
- Dossey, J. (1992). The nature of mathematics: Its role and its influence. In A. Douglas, & I. Grouws (Eds), *Handbook of research on mathematics teaching and learning*. New York: Macmillan. <https://www.researchgate.net/publication/243769794>
- Farrell, T., & Ives, J. (2015). Exploring teacher beliefs and classroom practices through reflective practice: A case study. *Language Teaching Research*, 19, 594-610. <https://doi.org/10.1177/1362168814541722>
- Fitzgerald, A., Hackling, M., & Dawson, V. (2013). Through the viewfinder: Reflecting on the collection and analysis of classroom video data. *International Journal of Qualitative Methods*, 12(1), 52-64. <https://doi.org/10.1177/160940691301200127>
- Freire, P. (1968). *Pedagogy of the oppressed*. New York: Continuum. <https://envs.ucsc.edu/freire-pedagogy-of-the-oppressed>
- Furinghetti, F., & Pehkonen, E. (2002). Rethinking characterizations of beliefs. In G. Leder, Pehkonen, E., & G. Törner (Eds), *Beliefs: A hidden variable in mathematics education?* (pp. 39-58). Dordrecht: Kluwer Academic. https://doi.org/10.1007/0-306-47958-3_3
- Getenet, S. (2013). Mathematics teacher educators' and pre-service teachers' beliefs about the use of technology in teaching in an African university. *International Journal of Innovative Interdisciplinary Research*, 2(12), 9-20. <https://www.researchgate.net/publication/282629910>
- Groth, R. E. (2013). Characterizing key developmental understandings and pedagogically powerful ideas within a statistical knowledge for teaching framework. *Mathematical Thinking and Learning*, 15(2), 121-145. <https://doi.org/10.1080/10986065.2013.770718>
- Harber, C. (1997). *Education, democracy and political development in Africa*. Brighton: Sussex Academic Press. <https://catalog.lib.uchicago.edu/vufind/Record/3002205>
- Harber, C., & Serf, J. (2006). Teacher education for a democratic society in England and South Africa. *Teaching and Teacher Education*, 22(8), 9686-9997. <https://doi.org/10.1016/j.tate.2006.04.018>
- Hénard, F., & Roseveare, D. (2012). Fostering quality teaching in higher education: Policies and practices. An IMHE Guide for Higher Education Institutions. Retrieved from <https://www.oecd.org/education/imhe/qt%20policies%20and%20practices.pdf>
- Holt, J. (1969). *How Children Fail*. Harmondsworth: Penguin. <http://www.amas.hk/pdf/shijianshenxue/5/1137>
- Ingersoll, R., Merrill, L., & May, H. (2014). What are the effects of teacher education and preparation on beginning teacher attrition? Philadelphia, PA: Consortium for Policy Research in Education, University of Pennsylvania. https://www.cpre.org/sites/default/files/researchreport/2018_prepeffects2014

- Kent, M., & Giles, M. (2017). Preservice teachers' technology self-efficacy. *SRATE Journal*, 26(1), 9-20. <https://files.eric.ed.gov/fulltext/EJ1134392.pdf>
- Kosnik, C., Menna, L., Dharamshi, P., Miyata, C., Cleovoulou, Y., & Beck, C. (2015). Four spheres of knowledge required: An international study of the professional development of literacy/English teacher educators. *Journal of Education for Teaching*, 41(1), 52-77. <https://doi.org/10.1080/02607476.2014.992634>
- Kulshrestha, A., & Pandey, K. (2013). Teacher training and professional competencies. *Voice of Research*, 1(4), 29-33. <http://www.voiceofresearch.org/doc/Mar-2013/Mar-2013>
- Marshall, C., & Rossman, G. B. (1999). *Designing Qualitative Research* (3rd Ed.). Thousand Oaks, CA: SAGE. <https://www.scirp.org/reference/referencespapers?referenceid=1851615>
- Miles, R., Lemon, N., Mathewson Mitchell, D., & Reid, J. A. (2016). The recursive practice of research and teaching: Reframing teacher education. *Asia-Pacific Journal of Teacher Education*, 44(4), 401-414. <https://doi.org/10.1080/1359866X.2016.1169502>
- Molle, D. (2013). Facilitating professional development for teachers of English language learners. *Teaching and teacher education*, 29, 197-207. <https://doi.org/10.1016/j.tate.2012.10.002>
- Murray, J. (2016). Beginning teacher educators: Working in higher education and schools. In & M. J. Loughran, *International handbook of teacher education* (Vol. 2, pp. 35-70). New York: Springer. https://doi.org/10.1007/978-981-10-0369-1_2
- Olawale, B. E. (2021). Democratic Citizenship in Mathematics Teachers' Preparation in South African Universities. Alice: Unpublished PhD Thesis submitted to the University of Fort Hare, South Africa. <https://jurnal.uns.ac.id/ijpte/article/view/61574>
- Olawale, B. E., Mncube, V. S., & Harber, C. (2021). Critical Social Pedagogy in Mathematics Teacher Education. *International Journal of Higher Education*, 10(6), 93-104. <https://doi.org/10.5430/ijhe.v10n6p93>
- Oleson, A., & Hora, M. T. (2014). Teaching the way, they were taught? Revisiting the sources of teaching knowledge and the role of prior experience in shaping faculty teaching practices. *Higher education*, 68(1), 29-45. <https://doi.org/10.1007/s10734-013-9678-9>
- Patton, K., & Parker, M. (2017). Teacher education communities of practice: More than a culture of Collaboration. *Teaching and Teacher Education*, 67, 351-360. <https://doi.org/10.1016/j.tate.2017.06.013>
- Peker, M.; Ulu, M. (2018). The effect of pre-service mathematics teachers' beliefs about mathematics teaching-learning on their mathematics teaching anxiety. *Int. J. Instr.*, 11, 249-264. <https://doi.org/10.12973/iji.2018.11318a>
- Pettit, S. (2011). Teachers beliefs about English language learners in the mainstream classroom: A review of literature. *Multilingual Research Journal*, 5(2), 123-147. <https://doi.org/10.1080/19313152.2011.594357>
- Prawat, R. (1992). Teachers' beliefs about teaching and learning: A constructivist perspective. *American Journal of Education*, 100(3), 354-395. <https://doi.org/10.1086/444021>
- Raymond, A. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for Research in Mathematics Education*, 28(5), 550-576. <https://doi.org/10.2307/749691>
- Robinson, M. & McMillan, W. (2006). Who teaches the teachers? Identity, discourse and policy in teacher education. *Teaching and Teacher Education*, 22(3), 327-336. <https://doi.org/10.1016/j.tate.2005.11.003>
- Rosas, C., & West, M. (2012). Pre-service teachers' perception and beliefs of readiness to teach mathematics. *Current Issues in Education*, 14, 1-23. <https://www.researchgate.net/publication/289629023>
- Roussouw, L., Rhodes, S., & Christiansen, I. (2009). Teachers' views on mathematics, mathematics teaching and their existing practices. Bellville: University of the Western Cape. <https://www.jet.org.za/resources/001738>
- Shapira-Lishchinsky, O. (2016). From ethical reasoning to teacher education for social justice. *Teaching and Teacher Education*, 60, 245-255. <https://doi.org/10.1016/j.tate.2016.08.010>

-
- Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Research*, 15(2), 4-15. <https://doi.org/10.3102/0013189X015002004>
- Skott, J.; Mosvold, R.; Sakonidis, C. (2018). Classroom practice and teachers' knowledge, beliefs, and identity. In *Developing Research in Mathematics Education: Twenty Years of Communications, Cooperation, and Collaboration in Europe*; Dreyfus, T., Artigue, M., Potari, D., Prediger, S., Ruthven, K., Eds.; Routledge: Oxon, UK, pp. 162-180. <https://doi.org/10.4324/9781315113562-13>
- Smith, K. (2003). So, what about the professional development of teacher educators?. *European journal of teacher education*, 26(2), 201-215. <https://doi.org/10.1080/0261976032000088738>
- Snoek, M, Swennen, A. & Van der Klink. (2010). The teacher educator: A neglected factor in the contemporary debate on teacher education. In B. Hudson, Zgaga, P & B. Astrand (Eds.), *Advancing quality cultures for teacher education in Europe: Tensions and opportunities*. Umea. Umea University Press. <https://research.hva.nl/en/publications/2010>
- Subba, D. (2014). Democratic values and democratic approach in teaching: A perspective. *American Journal of Educational Research*, 2(12), 37-40. <https://doi.org/10.12691/education-2-12A-6>
- United Nations Educational, Scientific and Cultural Organisation (Unesco) (2018). Education for democratic citizenship and inclusive social development, Background Paper 2. In *Europe and North America Education 2030 Consultation* (pp. 1-9). Strasbourg: Unesco. https://en.unesco.org/sites/default/files/eng-strasbourg_meeting-brochure
- Wei, R., Darling-Hammond, L., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad*. Dallas, TX: National Staff Development Council. <https://edpolicy.stanford.edu/sites/default/files/publications/2009>
- Yarema, S. (2015). The impact of professional development program on teachers' practice and how context variables influenced such practice: A case study. Unpublished PhD thesis, Wayne State University, Detroit. <https://www.researchgate.net/publication/282914361>