

Constraints Influencing the Efficacy of a PGCE Mathematics Program: A Case Study

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The learning attainment of South African learners in mathematics is, as The International Mathematics and Science Study (TIMSS) data reveal, far from optimal. A key contributing factor is a shortage of competent and confident qualified mathematics teachers. The Post Graduate Certificate in Education (PGCE) offered at South African universities is a key qualification designed to address this challenge (amongst others, such as the Bachelor of Education [B.Ed.]). However, the success of the PGCE as a preparation for mathematics teachers is not without concern, as this paper argues. Using a qualitative case study focusing on a PGCE with a mathematics focus offered by a university of technology, this paper discusses the constraints identified by prospective teachers and teacher educators. Constraints are explored by focusing on the curriculum, partnerships, and policy relating to the delivery of the PGCE as true and critical to the efficacy of the program. The paper contributes to context-specific understanding of the constraints influencing the PGCE's efficacy (as offered in 2014) in developing newly qualified teachers' (NQTs) skills and knowledge to be confident and competent mathematics teachers.

Les données d'une enquête internationale portant sur les acquis scolaires en mathématiques et en sciences (TIMSS) révèlent que le rendement des apprenants sud-africains en mathématiques est loin d'être optimal. Un facteur qui contribue de façon significative à ce phénomène est le manque d'enseignants qualifiés qui sont compétents et confiants. Le certificat d'études supérieures en éducation (PGCE) offert dans les universités en Afrique du Sud est une qualification importante conçue pour faire face à ce défi (le Baccalauréat en Éducation, entre autres). Toutefois, la réussite du PGCE comme outil de préparation pour les enseignants n'est pas sans inquiétude, comme le soutient cet article. En s'appuyant sur une étude de cas qualitative portant sur un PGCE avec une majeure en mathématiques et offert par une université de technologie, cet article discute des contraintes identifiées par de futurs enseignants et formateurs d'enseignants. Les contraintes sont examinées en se penchant sur le curriculum, les partenariats et les politiques relatives à la prestation du PGCE pour évaluer dans quelle mesure ils sont véritables et essentiels au programme. Cet article contribue à une compréhension, propre au contexte, des contraintes qui influencent l'efficacité du PGCE (tel qu'offert en 2014) à développer les compétences et les connaissances de nouveaux diplômés pour qu'ils soient des enseignants confiants et compétents.

Social change is restricted for around six in seven South African learners. This is because “approximately one in seven [South African] youths obtain a Grade 12 pass in [M]athematics” (Department of Basic Education [DBE], 2011, p. 68). According to the *Trends in International Mathematics and Science Study [TIMSS]* 2015, this low achievement is predicted to continue as

Grade 9 learners in South Africa scored at a low level in comparison to other participating countries (Reddy et al., 2016). Low achievement restricts access to employment and further studies requiring a background in mathematics. A key cause for learner underperformance is a shortage of confident and competent qualified mathematics teachers (Chetty, 2014; Spaull, 2012). This shortage is due to insufficient numbers of academically strong learners who are interested in a career as a mathematics teacher (Darling-Hammond, 2008; DBE, 2011; Jansen, 2013; Taylor, 2014). The Postgraduate Certificate in Education (PGCE) is a qualification designed to address the shortage. It offers non-teaching focused diploma or degree graduates (meaning graduates in fields such as engineering, business, or medicine, for example) an opportunity to become a qualified teacher in a single year (Department of Higher Education and Training [DHET], 2015). The PGCE is tasked with developing prospective teachers' *pedagogical content knowledge* within the assumption that *subject matter knowledge* was developed during a non-teaching focused diploma or degree (DHET, 2015; Taylor, 2014). For clarity, it is noted that South Africa offers two initial teacher education routes allowing an individual access to professional teacher status. Namely, a four-year Bachelor of Education (B.Ed.) program (accessible after completing Grade 12/high school) and the one-year PGCE (accessible to non-teaching diploma or graduates who wish to teach a subject linked to their non-teaching diploma or degree majors). Both qualifications are equal in status and the PGCE curriculum is greatly influenced by the B.Ed. curriculum (specifically content relating to pedagogy). The focus of this paper is the PGCE and the paper serves as a microanalysis of initial teacher education in South Africa. Within the above context, this paper seeks to address the question: What are the constraints impacting the delivery of the PGCE in South Africa at a provider (micro level) to develop a newly qualified mathematics teacher? The paper begins with a literature review of constraints influencing the efficacy of the PGCE. This is followed by an overview of the methodology and then three key themes (curriculum and its delivery, partnerships during delivery, and policy influencing delivery) to present an answer to the research question. The paper concludes by arguing that the success of the PGCE in preparing mathematics teachers is not without concern and its delivery needs rethinking.

Literature Review

This section discusses three constraint themes (curriculum, partnerships, and policy) affecting the quality of the PGCE. Curriculum is explored by discussing the perception of the one-year allocated to the PGCE and prospective teachers' subject matter knowledge (assumed fully developed because of completing a non-teaching focused diploma/degree) serving as the base to develop their pedagogical content knowledge. The Partnerships subsection explores the collaboration between appointees (teacher educators, mentor teachers, and teaching practice evaluators) during the process of linking existing subject matter knowledge with newly introduced pedagogical content knowledge. Policy is explored to identify the national (macro) expectations placed on an individual who completes the PGCE in South Africa. Related discussions are presented below to present conceptual understanding of constraints influencing the efficacy of the PGCE.

Curriculum and its Delivery

Curriculum constraints, as argued below, are related to how time is used to govern the PGCE. To begin, most universities do not focus on developing subject matter knowledge as this is a one-year

program assuming that the non-teaching focused diploma/degree granting access developed it. Instead, universities focus on general and subject pedagogy to develop pedagogical content knowledge in the one-year program (Naylor & Sayed, 2014). General pedagogy “focuses on basic teaching techniques such as general strategies and skills or procedures for teaching, for example, classroom discipline and management” (Reeves & Robinson, 2010, p. 237). General pedagogy is influenced by introducing general education theory involving “a range of general theories of education, schooling, and development related to teaching” (Reeves & Robinson, 2010, p. 237). It includes a focus on “learning about the social and historical contexts of education systems” and “theories of human and child development and learning” (Naylor & Sayed, 2014, pp. 9-10). It is commonly included in “foundation” modules focusing on “the psychology, history, philosophy and sociology of education” (Reeves & Robinson, 2010, p. 237).

Subject pedagogy, on the other hand, “focuses on how particular subjects are taught, and how to deal with common misconceptions or problems [learners] have in understanding the particular subject” (Reeves & Robinson, 2010, p. 237). Subject pedagogy can be delivered by one of two approaches, namely, “pedagogical theory and skills [are] generic and applicable within and across subject domains”; or related theory and skills are grounded “within a particular subject domain” (Reeves & Robinson, 2010, p. 244). The first approach overemphasizes the “how” of teaching without giving due attention to developing subject matter knowledge and the unique requirements attached to teaching specialised subject content (Davis, Adler, & Parker, 2007; Reeves & Robinson, 2010). The second approach overemphasizes the importance of subject matter knowledge without giving due attention to “the complexities of transforming [subject matter knowledge] into appropriate opportunities for learning in school classrooms” (Adler, Slominsky, & Reed, 2002, p. 151). As a whole, pedagogy-focused engagements occur in one (or a combination) of three approaches, namely: teaching theories before putting them into practice; “constructing” theories or “extracting” principles from practical experience; and/or teaching theories with practice (Reeves & Robinson, 2010, p. 238). The discussion to follow explores the validity of the assumption that all prospective teachers in the PGCE hold the desired level of subject matter knowledge.

The PGCE curriculum is anchored in the assumption that all prospective teachers who have completed a non-teaching focused diploma or degree hold the subject matter knowledge needed to actively engage during scheduled engagements. We argue that this assumption is flawed and constrains the program’s efficacy. To clarify, its curriculum focuses on the “relationships between [pedagogical content knowledge] and [subject matter knowledge]” to develop subject pedagogy (Reeves & Robinson, 2010, p. 237). This is done by introducing prospective teachers to engagements aimed at developing a deep understanding “about what makes a particular topic easy or difficult for [learners] to understand, the common misconceptions that [learners] may have on a particular topic, and the strategies on how to deal with such issues” (Brijlall & Maharaj, 2014, p. 107). Interestingly, some prospective teachers struggle to simplify the school mathematics (in a mathematically sound fashion) when explaining content to learners even though they have been introduced to the relationship between pedagogical content knowledge and subject matter knowledge (Ingvarson et al., 2014). That is to say, majors at the university level in a non-teaching diploma or degree do not guarantee that the desired level of subject matter knowledge, as needed in the program context, was developed. This highlights a potential misconception about subject matter knowledge held by prospective teachers who are non-teaching focused diploma or degree holders. It is potentially more accurate to refer to the subject matter knowledge held by such graduates as common content knowledge. Common content

knowledge involves the ability to complete mathematics as included in the prescribed curriculum and focuses on skills and knowledge related to doing school mathematics (Ball, Thames, & Phelps, 2008). A potential gap in non-teaching focused diploma and degree graduates' subject matter knowledge is related to specialized content knowledge. Specialized content knowledge, as a component of subject matter knowledge and an extension of common content knowledge, involves the ability to simplify mathematics and mathematical concepts/definitions as far as is mathematically sound (Ball et al., 2008). Specialized content knowledge, as a component of subject matter knowledge, is differentiated from pedagogical content knowledge as the latter involves "significant mathematical resources; but [does] not yet necessarily require knowing about [learners] or teaching" (Ball et al., 2008, p. 397). Specialized content knowledge is specialized knowledge about mathematics only needed and held by individuals who consider themselves as being mathematicians and involves knowledge and skills to simplify mathematics in a mathematically sound fashion (Ball et al., 2008). To build on the understanding of constraints within the context of the time available and knowledge assumed in place, focus is placed on the relationships between the individuals appointed to deliver PGCE modules and teaching practice.

Partnerships During PGCE Delivery

Another emerging constraint in the PGCE is the potential misconception that a strong partnership between all appointees (teacher educators, mentor teachers, and teaching practice evaluators) occurs naturally. This misconception, we argue, exists when the general conditions of appointment in the PGCE are considered. For example, if a large component of the teacher educator body is appointed on a part-time basis, they are not guaranteed to be "part of a faculty-wide conversation about [governance], nor do they have a sense of [the curriculum] into which their efforts might fit" (Darling-Hammond, 2006, p. 310). By not being part of a faculty-wide conversation, some teacher educators might assume, for example, that record keeping and classroom management are introduced and developed during teaching practice (Mutemeri & Chetty, 2011, p. 514). When prospective teachers enter teaching practice and are unable to complete tasks such as record keeping and classroom management, the host school might question the value of the PGCE, in turn causing prospective teachers to question its value (Mutemeri & Chetty, 2011, p. 515). This might cause mentor teachers to perceive the prospective teachers as needing more assistance than what they are expecting and able to offer (Heeralal & Bayaga, 2011, pp. 101-103). The situation is further complicated by appointing contract staff (i.e. those not directly involved in the delivery of PGCE modules) to formally evaluate teaching practice lessons on behalf of the university (part-time appointed teacher educators are not available to observe and assess teaching practice as they are involved in other university programs) (Robinson, 2015, p. 48). Although the appointment of contract staff allows all prospective teachers to be observed and assessed by a university representative, the value of the observations and assessments during teaching practice is questionable (Heeralal & Bayaga, 2011, p. 103).

In conclusion, a weak partnership between appointees restricts the development of a professional learning community (PLC) where all involved understand how their contribution fits into the whole process of learning to teach via the PGCE (Feldman, 2016, p. 65). Surely, to promote a quality program and the development of a professional learning community, the formal program curriculum must clarify to all involved how their contribution fits into the whole development process. Interestingly, teacher education providers and the government have not yet come together and agreed upon a "common [PGCE] curriculum" (Sayed, Badroodien, Salmon, &

McDonald, 2016, p. 67) to formally clarify the links between—and expectations of—modules and teaching practice to guide facilitators. The section to follow explores policy stipulations that govern the delivery of the PGCE in the absence of a “common curriculum”.

Policy Influencing PGCE Delivery

To govern PGCE delivery at national/macro level, the *Revised Policy on the Minimum Requirements for Teacher Education Qualifications [MRTEQ]* (19 February 2015) stipulates that two complimentary components comprise the PGCE in South Africa, namely, a university-based component in the form of a developed learning program (modules); and a school-based component stipulated in policy as “work-integrated learning” (WIL) (commonly known as teaching practice) (DHET, 2015, pp. 10–11). The MRTEQ stipulates that eight to twelve weeks of the PGCE year is to be dedicated to teaching practice (DHET, 2015). MRTEQ, as a key teacher development policy, presents five types of learning (disciplinary; pedagogical; practical; fundamental; situational) associated with the acquisition, integration, and application of knowledge for teaching purposes (DHET, 2015, pp. 10–11). It further identifies the “seven collective roles of the teacher in South Africa” (specialist in a phase, subject, or practice; learning mediator; interpreter and designer of learning programs and materials; leader, administrator, and manager; scholar, researcher, and lifelong learner; assessor; community, citizenship, and pastoral role) (DHET, 2015, pp. 58–59). It also lists eleven policy expectations placed on a newly qualified teacher (NQT) (DHET, 2016) and notes that “[t]he minimum set of competences required of a [NQT] is outlined in [the MRTEQ], and the knowledge mix selected for [the PGCE] must lead to the development of these competences” (DHET, 2015, p. 11). These eleven NQT policy expectations were included to indicate the differences between expectations placed on experienced teachers and those placed on NQTs to influence content and engagements during teacher preparation and development (Deacon, 2012). Crucial to this paper, the following are included in both expectations placed on NQTs and the seven roles placed on teachers as stipulated in the MRTEQ: having knowledge of the subject, teaching, diverse learners, assessment, communication, creating environments conducive to learning, school curriculum, and professional conduct. Understanding that the purpose of the eleven expectations placed on NQTs is to differentiate expectations placed on experienced NQTs and experienced teachers, the three differences are noted. Firstly, there is no mention of holding “highly developed literacy, numeracy and IT skills” in the expectations placed on NQTs as stipulated in the expectations placed on experienced teachers. Secondly, the “expectations placed on NQTs” makes no mention of the “pastoral role” stipulated in the “seven teacher roles” in the MRTEQ. Lastly, “expectations placed on NQTs” states “design suitable learning programs”, whereas “the seven teacher roles” states “design original learning programs”. If something is designed, is it not automatically original? In conclusion, the difference between national/macro policy expectations placed on an experienced teacher and a NQT, as found in the MRTEQ to influence the delivery and content in the PGCE, requires clearer differentiation (Deacon, 2012). This lack of clarity, we argue, could be a key contributing factor constraining (instead of promoting) the delivery of a quality PGCE.

The review above highlighted three related constraints that influence the quality of the program: curriculum, partnerships, and policy. These now serve as the conceptual framework for the remainder of this paper, in which we will explore a PGCE by means of the following action plan.

Methodology

The paper draws from a qualitative case study of a PGCE program in the Western Cape offered by a university of technology. The university was purposefully sampled for two reasons. First, it is one of the larger providers of initial teacher education in South Africa. Second, it was willing to grant access to teacher educators (interviewed end 2014) and to NQTs (interviewed beginning 2015) in its 2014 PGCE mathematics program. The case study used semi-structured interviews and document analysis. Six NQTs and five teacher educators were interviewed. Contact was made with the 26 NQTs included on a university class list who participated in the 2014 PGCE with Mathematics Didactics as an elective. Only six volunteered to be interviewed. Contact was made with eleven teacher educators who facilitated PGCE modules in 2014, which included the group who selected Mathematics Didactics. Five volunteered to participate. Documents analyzed were study guides, university (micro) policies, the program guide, faculty handbook, university website, and prospective teachers' portfolios. Data was analyzed using Tesch's coding method (Tesch, 1990), allowing for three themes relating to program constraints to emerge from the qualitative data. These emerged by using codes (curriculum, partnerships, and policy) linked to the paper's conceptual framework to analyze and organize data. The authors were not part of the PGCE under analysis, nor served as teacher educators during the period of data collection. The coding method involved the following five steps (Tesch, 1990, pp. 142-145):

1. All collected data was read to reveal its richness and extent.
2. All collected data was compiled into a single Word document to allow for original documents to be filed away for safe keeping.
3. The Word document was printed to allow for codes, themes, and categories to be written on the document and to highlight related data with the same colour highlighter.
4. Theoretical saturation was perceived as established once all the data has been read and no new codes, themes, or categories arose.
5. The original source documents were re-read to identify any potential aspect overlooked during the process of compiling a single Word document of all the collected data. If an aspect was found, it was included as an annexure to the original Word document to highlight and write the related code, theme, and category on the paper.

The methodology is arguably suitable as the findings are specific to the case and not meant for broader generalisation. All ethical requirements that are common with such a project were followed and ethical clearance was obtained from the relevant ethics committee. The context-specific constraints emerging from data are presented under the following three themes: curriculum and its delivery; partnerships during delivery; and policy influencing delivery. The logic behind the above sequence is to develop an argument that the first two context-specific constraint themes are caused by the last. The next section discusses the first theme by presenting the context of the case study as an introduction followed by three emerging categories.

Curriculum and its Delivery

The PGCE aims to develop general and subject pedagogy to make the best use of the year allocated to the PGCE. Subject matter knowledge is assumed in place because all prospective teachers complete a non-teaching focused diploma or a degree linked to at least two school subjects.

General pedagogy is developed during the modules: Professional Studies, Introduction to Research, Perspectives on Education, Educational Management, Language Development and Communication, Life Skills (Information and Communications Technology [ICT] skills) and Health and Safety in Education (first aid, health and safety legislation, HIV/AIDS education). Subject pedagogy is developed during the two electives (Didactic A [Mathematics or Business Studies] and Didactic B [a second school/college subject linked to Didactic A]). The PGCE does not develop subject matter knowledge. The PGCE uses continuous assessment (tests, assignments, university templates, and presentations) with limited re-assessment opportunities. Teaching practice (four weeks in terms 2 and 3 respectively) is assessed as a separate module linked to Didactics and Professional Studies. The PGCE timetable divides prospective teachers (in groups of over 100) into two groups during Didactic A (31 in Mathematics and in groups close to a total of 70 in Business Studies for 2014). These two groups are divided into smaller groups during Didactic B. All prospective teachers attend compulsory modules together. Contact sessions are delivered during the afternoon/evening, allowing employed unqualified teachers to complete the PGCE in one year alongside full-time prospective teachers. Within the context of curriculum and its delivery, three categories are used to organize the discussion of this theme. The first focuses on the ever-increasing numbers of prospective teachers granted access into the program that teacher educators are expected to develop into competent and confident teachers. The second highlights ICT infrastructure challenges negatively influencing the delivery of the PGCE curriculum. The third notes potential challenges in using B.Ed. content because such were designed to be delivered over a longer period than allocated to the PGCE. The first of the three categories are explored below.

Forced Growth Promotes Quantity but Constrains Quality

The PGCE has experienced dramatic growth in the number of prospective teachers who are pursuing/accessing the program. Specifically, the PGCE attracted/accepted “less than 10 students [in 1994]. In 2014 over a 100 [were accepted]. This year [2015] [they] accepted 207” (Teacher educator (TE) Professional Studies/program coordinator). The key reason noted for this growth is the external demand by government on universities to develop more teachers. Within this context, teacher educators noted that “[t]here is a shortage of teachers and the emphasis of the Department of Higher Education [DHET] is the PGCE” (TE Introduction to Research). The above clarifies why numbers were able to increase from the university side of the scale. This understanding is summarized as being *forced growth*. To add to this, the key reason why prospective teachers pursue the PGCE is explored.

A key aspect driving forced growth, from the perspective of the interviewed teacher educators, is the slow economic and job growth in South Africa. More specifically, all interviewed NQTs were non-teaching focused diploma graduates (with mathematics as a major) who pursued the PGCE (with Mathematics Didactics as an elective), as they were unable to access meaningful employment with their diploma. Specifically, there is a link between slow economic growth and an increase in PGCE registrations over the last couple of years as mentioned by the PGCE program coordinator: “As the economy goes down the PGCE enrolments has been going up” (TE Professional Studies/program coordinator).

This increase unfortunately comes at the cost of quality. More specifically, appointed teacher educators are not completely certain that they are able to develop competent and confident teachers because of the forced growth in conjunction with the perceived limited time of one-year

allocated to delivering the PGCE curriculum. The teacher educator for Mathematics Didactics specifically noted this as a key constraint in the context of forced growth and delivering the curriculum:

In 2011, I started with 7 students. In 2014, 31. But to have 31 students evaluated on a personal level ... you can't do that in 2 hours or at least let's say 40 weeks as I could do with 7 ... I don't know always know what I am actually sending out (TE Mathematics Didactics).

In addition, teacher educators mentioned that the forced growth process allows access to prospective teachers who do not hold basic abilities that are assumed to be in place in all university graduates. These include referencing and being able to use and access e-mail. For example, the one teacher educator specifically noted the following: "[T]hese people were afraid to tell me that we do not know what e-mail is: 'We don't know this so we don't have any of those things'. They missed out on a lot of opportunities" (TE4 interview). Unfortunately, such gaps go undiagnosed in the beginning of the year because of the forced growth and the assumption that such skills are in place. This is mainly because the number of prospective teachers increase annually but the timetable for contact sessions and allocated consultation hours for the PGCE does not increase in tandem. This was identified as one of the key contextual factors influencing the quality achievable from the PGCE: "But there you pick up the problem ... they end up with 43 percent at the end of the year" (TE2/program coordinator interview). It is logical to conclude that if basic abilities go undiagnosed, so do potential gaps in subject matter knowledge. If a strong understanding of subject matter knowledge is not in place, it will be a challenge to link subject matter knowledge with newly introduced pedagogical content knowledge during the PGCE (Ingvarson et al., 2014, p. 8).

In conclusion, the program is successful in increasing the quantity of prospective teachers in the field of mathematics. Unfortunately, it is not an absolute guarantee that the graduate is a competent and confident mathematics teacher. This potentially leads to some of the program graduates entering classrooms ill-prepared in relation to the expectations of the employer. The discussion to follow explores constraints caused by the university infrastructure and the capacity to make best use of the existing infrastructure.

ICT Infrastructure and Fluency Constrain the Efficacy of Academic Support

Academic support to assist in curriculum delivery was constrained because of challenges with the university ICT infrastructure, namely access to a computer, the internet (Wi-Fi), and printing. Access to the ICT infrastructure was restricted for some because there was only one computer laboratory housing outdated devices in 2014. This computer laboratory, from the perspective of the interviewed NQTs, was insufficient for the large number of prospective teachers during times when assessments were due in a printed format. In addition to the quantity of computers, the perceived outdated equipment was also frequently out of order. Challenges with the ICT infrastructure created the following perception amongst the interviewed NQTs: "[T]hey don't care about the computer lab. I have to be honest with you ... [T]here is only one lab with an old machine ... and old everything" (NQT5 interview).

Teacher educators also voiced concerns about the ICT infrastructure influencing their ability to offer academic support to deliver the curriculum. These were documented in a submission made by the university to a government-funded oversight body and published on the university's

official website as follows: “Many staff members complain about printing facilities and the lack of Wi-Fi access in classrooms ... Requisitioning equipment (when one has the funds) is slow” (university of technology website).

Challenges with printing facilities might have caused some teacher educators to make use of limited notes during contact sessions to assist in the delivery of the curriculum. For example, a NQT reflected that “most of the time ... they [teacher educators] will talk to you; they won’t really give you notes” (NQT5 interview). In addition, it emerged that limited additional notes were published on the official online communication platform accessible from the university website. This caused prospective teachers, especially those who completed a non-teaching diploma at the university (specifically those who completed a National Diploma in Mathematical Technology), which granted access into the PGCE, to question the academic support provided by appointed teacher educators, specifically in comparison to the academic support provided during their non-teaching focused diploma, which is perceived as having developed the desired level of subject matter knowledge (common content knowledge and specialized content knowledge) to cope with the PGCE curriculum. This comparison between expectations based on past exposure to the online platform while completing a non-teaching diploma was emphasized as follows on the course evaluation questionnaire submitted to the program coordinator: “What is the use of Blackboard [online platform]: no grades are on there, no notices and notes were on there” (NQT6 written response on course evaluation questionnaire).

Access to physical academic reading materials was also restricted because of challenges with the ICT infrastructure. To clarify, because it was challenging to access a computer in the laboratory to access the internet, it is logical to assume that it was a challenge to access online academic materials. If online academic materials were actually accessed, it was a challenge to print a copy to read offline. This caused the demand for physical academic reading materials to exceed the supply as available in the university library, especially when assessments were due as mentioned here by NQT2 during an interview: “[W]hen there is tests or assignments everybody goes to the library and they take books. The books would be there but there would not be enough” (NQT2 interview).

The discussion above revealed that the ICT infrastructure restricted access to both online and physical academic reading materials to assist prospective teachers to meet PGCE curriculum requirements. It also potentially indicates a lack of digital fluency in both teacher educators and prospective teachers in terms of making use of the available ICT infrastructure. In summary, challenges with the 2014 ICT infrastructure, and incapacity to make best use of it, constrained the efficacy of academic support in the PGCE during curriculum delivery. The discussion now turns to how the PGCE content is selected/developed to deliver the curriculum.

B.Ed. Fourth Year Content Constrains the PGCE in Developing Specialized Content Knowledge

Although from the perspective of the interviewed teacher educators, there is no “blue print that says in PGCE you must” (TE Introduction to Research), the common practice at the university is to make use of B.Ed. fourth-year content as the PGCE curriculum. The program is therefore a condensed version of the university four-year B.Ed. degree as it uses its content. In support, the teacher educator for Mathematics Didactics clarified his approach to the PGCE curriculum in 2014 as follows: “I built up my mathematics curriculum on the B.Ed. 4 subject Didactic for mathematics” (TE Mathematics Didactics).

B.Ed. content is designed to be delivered over a period of four sequential years, concluding with subject administration. Subject administration in this context involves conducting lessons in a classroom context and compiling subject files containing evidence of lessons and assessments conducted. For this reason, Mathematics Didactics only focused on subject administration. This focus, as clarified in the quote from the teacher educator for Mathematics Didactics below, restricted development of specialized content knowledge in the PGCE context: “There is no specialised mathematical knowledge [specialized content knowledge] introduced only needed to be known by mathematics teachers ... I mainly focus on subject administration ... I am aware that others focus on it” (TE Mathematics Didactics). The focus on subject administration in the B.Ed. included a six-month teaching practice period to cement the learning and development that occurred during the preceding years. This practice made NQTs doubt the value of their training and development in comparison to the development done in the B.Ed. For example, one NQT specifically noted during his interview that “[t]hey [B.Ed. prospective teachers] take six months ... to be at school ... Unlike us [PGCE prospective teachers] who come for one month again and then that is it” (NQT2 interview). In an attempt to match the development of subject administration perceived achieved in the B.Ed. in the PGCE, all modules had a common focus of developing subject administration knowledge and abilities. More specifically, this development involved focusing on aspects such as lesson planning (including identifying and selecting methods and media), assessment planning (including designing and conducting assessments), and classroom management. This common focus was unfortunately more of a constraint than an asset because it caused prospective teachers to experience, from their perspective, unnecessary duplication of content and tasks across PGCE modules and Teaching Practice. The teacher educator for Mathematics Didactics specifically noted that he is “aware that there is duplication, but he makes sure that [prospective teachers] “know about it [subject administration]” (TE Mathematics Didactics). For this reason, the lack of a PGCE blue print constrains the PGCE efficacy as the common practice of using B.Ed. fourth year content overemphasizes subject administration and ignores the development of specialized content knowledge. To clarify, the PGCE does not develop subject matter knowledge (common content knowledge or specialized content knowledge) as it is assumed fully developed during the non-education focused diploma or degree, which granted access into the program. The second constraint focused theme is explored below.

Partnerships During Delivery

This theme explores the potential misconception that collaboration between teacher educators, mentor teachers, and teaching practice evaluators occur naturally within the case study context. To assist, one category emerging from data are used to highlight the part-time nature of appointment in the program constraining strong partnerships between all involved in it.

Part-Time Appointees Constrain Academic Support Structure Efficacy

Academic support in the PGCE context is constrained because of the part-time nature of the appointment of both teacher educators and teaching practice evaluators. Most of the teacher educators, as mentioned by the program coordinator, were paid extra to facilitate a PGCE module. It was a responsibility on top of their existing heavy teaching load in the B.Ed. program. The part-time nature of the appointment is firstly a constraint as it restricted opportunities for formal and

informal meetings between all those appointed to facilitate PGCE modules. This point was emphasized by the teacher educator for Mathematics Didactics as follows: “[T]here have been a few meetings with the part-time people but not much because half of the people you don’t know and you don’t see actually” (TE Mathematics Didactics). It is not proposed that meetings are essential to promote quality. It is argued that both formal and informal meetings create opportunities to share ideas and clarify a common goal/approach for the PGCE. For example, it might be assumed that all who facilitate PGCE modules are aware of the development and training that takes place during didactics to develop subject pedagogy and present compulsory modules in a manner linked to didactics. Unfortunately, this was not the practice in the PGCE. The teacher educator for Perspectives on Education specifically stated: “And I know they have a lot of didactics ... I am not very sure what they do in there” (TE Perspectives on Education). In addition, appointment as a teacher educator on a part-time basis does not include the allocation of time to evaluate teaching practice. This is because of existing time commitments linked to the full-time B.Ed. schedule. Because of this, external teaching practice evaluators are needed to assist the university to evaluate the increasing number of prospective teachers in the PGCE. To clarify, the teacher educator for Mathematics Didactics noted that the university appoints “people from the outside, retired teachers, principals ... So, they go out and actually evaluate teaching practice ... I have no idea who they are” (TE Mathematics Didactics). Appointment as a teacher educator also does not include time to meet with external staff appointed to observe Teaching Practice to identify development needs of prospective teachers. In addition, it is assumed that appointment as a teacher educator in the PGCE did not include formal meetings or engagements with mentor teachers hosting prospective teachers during teaching practice. This is potentially the key cause for unnecessary duplication of teaching administration related tasks during teaching practice. To clarify, some NQTs noted that as a prospective teacher they were required to re-do lesson plans on the host school’s lesson plan template in addition to completing the lesson plan on the university template. This was perceived as unnecessary by the NQTs and most likely caused by a lack of partnership between teacher educators (or the university) and mentor teachers. The following quote emphasizes the frustration felt:

Because here [teaching practice host] we are given a lesson plan which goes this way. Now at [university] filing department or whoever those people are, are going to give you something totally different right. The templates are different. They want you to use the [university] one, but when you are presenting it to your [teaching practice host] here they want their own one. It does not make sense. (NQT5 interview)

In conclusion, the potential misconception that collaboration between teacher educators, mentor teachers, and teaching practice evaluators occurs naturally was identified as holding true in the case study context. The part-time nature of appointment in the program emerged as the key constraint restricting partnerships to be established to promote collaboration between all involved and to avoid unnecessary duplication of activities. The discussion now turns to how the program was governed and managed from a policy context.

Policy Influencing Delivery

This theme explores how policy related to the case study context was implemented to promote the

delivery of a quality program. One category emerged to guide the discussion of policy-linked constraints influencing the efficacy of the PGCE.

Lack of Oversight Over Policy Implementation Constrains PGCE Efficacy

Although university (institutional) policy included an array of stipulations to guide PGCE delivery, the discussion below reveals that those responsible for the delivery of the PGCE did not follow all of them. To begin, university policy stipulated that all initial teacher education programs offered by the university should provide prospective teachers with an “assessment plan/program/calendar” (university policy) to communicate assessment deadlines and to promote an even spread of due dates. During interviews, it emerged that prospective teachers did not receive a university policy-stipulated assessment plan, as noted in the following statement: “The assignments that were done due dates were all on top of each other. I don’t think they actually had an assessment program” (NQT6 interview).

University policy also stipulated that if a prospective teacher was absent for five or more days during Teaching Practice, they would have to re-do it. One prospective teacher who was absent for five teaching practice days, went unnoticed (“I missed a whole week during this time which no one noticed” [NQT6 interview]), as he submitted the paperwork attached to teaching practice assessment. In addition, even if a prospective teacher was present for all the days allocated to Teaching Practice, they were not guaranteed to be engaged in formal teaching practice assessments linked to PGCE modules. In support of this point, one participant noted:

I could not do my assessments as asked because my mentor told me that they are behind with CAPS document, also their June performance was very low they need to do intervention tasks with their learner. I cannot do project and investigation because that will waste time they do not have. (NQT3 Approach Mathematics Didactics WIL2)

Concerning the above claim and university policy stipulations, mentor teachers were expected to handle logistical arrangements and initiate “a goal directed guidance plan of action ... to ensure that the [prospective teacher] develops in a meaningful way during the period in the classroom” (university policy). The existence of “a goal-directed guidance plan of action” (university policy), either provided by the university or developed by the host school, is in doubt as most of the NQT reflections about Teaching Practice involved it being too limited in time and contributing little to their development as a teacher. This was best emphasized in the following quote taken from a Teaching Practice linked assessment:

They [learners] seem to already know the work that was given or taught in class. This made me a bit confused on whether to continue to on something else or teach what they already know. So, I kept on jumping what was on the lesson plan. (NQT1 Approach Mathematics Didactics WIL2)

In conclusion, a lack of oversight over university policy implementation leaves stipulations toothless. By being toothless, this lack of oversight does not promote program quality. The discussion above indicates that there are challenges in the governance and management of the delivery of the PGCE as per university policy stipulations, which is potentially the key constraint causing the preceding identified constraints to emerge. The section to follow summarises the contribution to understanding.

Discussion

So, what are the constraints impacting the delivery of the PGCE in South Africa at a provider (micro level) to develop a newly qualified mathematics teacher? The first constraint identified involves ever-increasing numbers of prospective teachers that need to be accommodated by academic support structures and inadequate ICT infrastructure. This indicates that the PGCE is not immune to the modern mantra of doing more with less. Because the PGCE as stipulated in national policy is equivalent to the four-year B.Ed., there is potentially an overreliance on B.Ed. developed content which is not always perfectly suitable for the PGCE context. The constraint, it is argued, is the need to develop PGCE context specific content to make best use of the one-year allocated to equip prospective teachers with knowledge and skills that will allow them to meet the national policy expectations placed on newly qualified teachers (and the seven roles placed on teachers). Concerning content, it is of interest to note that none of the teacher educators noted the MRTEQ (DHET, 2015) as influencing the content included in the module they delivered. Exploring the delivery of the PGCE further, it emerged that the development of a professional learning community between teacher educators, mentor teachers, and teaching practice evaluators was constrained. This was because of the part-time nature of appointment to work in the PGCE. The part-time nature is a constraint as it restricted opportunities for all to engage with each other for the sole purpose of enhancing the efficacy and quality of the PGCE. In addition, this phenomenon contributed to prospective teachers being exposed to unnecessary duplication of engagements and tasks, which should not happen in a program to be delivered over a limited period of one-year.

The last constraint identified involved a lack of oversight over university policy stipulations relating to Teaching Practice and assessment in the program. If all involved do not follow university policy, it indicates that adherence to such stipulations are not monitored by the relevant authorities. For this reason, we argue that the constraints identified in this paper are caused by a lack of oversight over university policy. In addition, if there is a lack of oversight over university policy, it is logical to conclude that a lack of oversight over national policy implementation at the institutional level might also exist.

Closing

The paper began with a literature review focusing on constraints and the PGCE in South Africa. Data was analyzed by drawing on a case study of a PGCE program at a university of technology in the Western Cape. The aim was to understand constraints that undermine the policy vision of producing confident and competent mathematics teachers in South Africa.

Overall, there are several challenges that suggest that program graduates may need further development and support to become confident and competent mathematics teachers. If further development and support is not provided, the learning gained during the PGCE might be perceived as being inadequate and not of sufficient quality. In highlighting these constraints, this paper contributes to building the knowledge base of the gap between national and institutional teacher education policy and provision. By closing this gap, initial teacher education can provide quality teaching and learning to improve learner performance in mathematics in South Africa.

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