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Grade 3 teachers' understanding of the implemented mathematics curriculum content

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ABSTRACT

This pragmatic action research explores Grade 3 teachers' understanding of the implemented mathematics curriculum content. Exploring teachers' understanding of the mathematics curriculum content is required because understanding of content determines how teachers teach, the resources they use, and how teachers assess. It should be noted that, over time, curriculum reforms take place; and these reforms impact not only on teachers' knowledge, expertise, or motivation, but also on their understanding. Understanding, as synthesised by the researcher, is a planned, prescribed system of presenting one's thoughts and expertise regarding a particular subject; in this case, mathematics. In exploring this phenomenon, six Grade 3 teachers from Nkangala District in Mpumalanga were purposefully sampled to be part of this study. Data was generated through two phases of reflective activities, observations, interviews, and a focus-group discussion. To answer the two research questions of this study, the generated data was analysed guided by the natural identity framework themes. Findings revealed that teachers' understanding of the implemented mathematics curriculum content is mostly informed by a combination of their need to comply with the prescripts of policy and higher authority, common understanding to appease their societal needs, and individual understanding based on their experiences and beliefs. The study drew the conclusion that, for teachers to embrace the three propositions of understanding and identities, teachers' natural understanding identity should be promoted. This identity is underpinned by reflective practice and adaptation to what works in their day-to-day practice as teachers.

Introduction

The main purpose of this study is to explore teachers' understanding of the implemented mathematics curriculum. The next section, therefore, presents a comprehensive literature review on teachers' understanding of the South African Mathematics Curriculum and Assessment Policy Statement (CAPS). The section opens by discussing teachers' understanding as a phenomenon of this study. Next, special focus will be on the expert, common and individual understanding. This will be followed by reviewed literature on content, assessment and the learning environment. Subsequent to the literature review is an introduction of the NIF, which is a framework for analysis of this study, followed by research design, findings, conclusions and implications of the study for future research.

Curriculum implementation is a representation of curriculum for teachers who are the main users. Implementation of curriculum occurs when teaching and learning take place (Van den Akker *et al.*, 2009). As Polly (2017) posits, it is during the implementation phase that each teacher has the autonomy to modify the curriculum in their classrooms, deciding what to incorporate or to discard; and how to teach activities from the same curriculum. The intended curriculum concerns intentions of policymakers and curriculum developers at the developmental or design level nationally: such are found in curriculum policy documents. These national policies provide details of subjects to be taught, content that learners are to learn, reflecting visions or rationale, aims, teaching methods, time allocation and assessment, both formal and informal (Booyse & Du Plessis, 2014; Khoza, 2014; Deng, 2010). Therefore teachers, as frontline implementers, have the responsibility of ensuring that the curriculum is implemented as planned in schools, especially in

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countries that use a national curriculum as in South Africa. These expectations by authorities on teachers position teachers as experts, hence the demand to explore their capacity for understanding of content at the level of experts.

This responsibility is, however, not always possible − teachers at implementation level make decisions while teaching. In essence, the success of implementation also depends, to some extent, on how teachers understand what they have to teach, because it is at the implementation level that teaching and learning take place. Teachers therefore need expert understanding to align themselves with the demands of the mathematics curriculum.

The purpose of this study was to explore Grade 3 teachers' understanding of the implemented mathematics content in Nkangala District, Mpumalanga. To achieve the study purpose, the following questions were asked:

i. What are the Grade 3 teachers' understandings of the implemented mathematics content, and how is the content to be implemented?
ii. Why do Grade 3 teachers understand the implemented mathematics content the way they do?

This literature review section therefore presents a comprehensive literature review on teachers' understanding of the implemented mathematics curriculum content. The chapter opens by discussing teachers' understanding as a phenomenon of this study. Next, special focus will be on the expert understanding, common, and individual understanding of the curriculum as explored by scholars who specialise in curriculum matters. Lastly, there will be a discussion on curriculum content, teacher roles, learning activities, assessment, and environment.

Literature Review

Theoretical and Conceptual Background

Expert understanding

Expert understanding is aligned with the discipline, subject, curriculum, or professional needs (Khoza, 2015a). Teachers who have expert understanding rely heavily on understanding facts related to their subject, specific content of the particular subject, specialised assessment requirements and their professional roles as teachers. Of importance also is the teachers' level of qualification and specialisation in the subject; because if teachers are specialised to teach the subject, it is likely that they will also excel in teaching the subject, knowing and understanding the content. However, Moru *et al.* (2014); and the Centre for Development and Enterprise (2014)'s findings revealed that in the early grades of schooling, most teachers are either unqualified or underqualified to teach the mathematics that they are expected to teach. Teachers obtained either a certificate or a diploma which qualified them to teach; however, not to specialise in teaching mathematics. The Centre for Development and Enterprise (2014) acknowledged that in South Africa there is a shortage of teachers qualified to teach mathematics, amongst other subjects. The findings do, however, indicate that there is a lack of a significant relationship between teachers' qualifications and how learners perform, together with the qualifications' effect on the experience of teachers. These findings are contrary to the findings of Molapo and Pillay (2018), who posit that the higher the teacher's qualification, the more productive and better results they produce. Notwithstanding these findings, teachers do need to be grounded in expert mathematical understanding to be able to interpret the foundational and theoretical position of mathematics. Such will enable them to implement the curriculum according to the given prescripts.

Bernstein (1999) refers to such as vertical, school, or official knowledge, because the curriculum is coherent, explicit, and with a systematically principled structure. Skemp (1976) further adds that expert or instrumental understanding promotes proper teaching. Such is based on a fixed plan of what to teach, what to learn, and what to assess. The curriculum provides no room for deviation, as what is to be done is provided. Furthermore, Bernstein (1999) qualifies his viewpoint by indicating that understanding of this nature is hierarchically organised, having strong distributive rules regulating access (who), transmission (how), and evaluation (assessment). This viewpoint resonates with that of Khoza (2016) that, in professional or expert understanding, each subject or discipline is separate from other subjects and uses subject-specific terminologies or concepts. This is driven by identified specialised content, in which all teachers teach the same body of knowledge from the lowest to the highest levels of the cognitive domain.

Common understanding

Implementation of the curriculum from the common understanding perspective occurs when teachers understand implementation of curriculum as informed by the needs and opinions of the wider community they serve (Khoza, 2015a; Ngubane-Mokiwa & Khoza, 2016a). Common understanding in this sense may be positioned as an understanding that everybody else has, even a lay person. According to Khoza (2016), Bernstein (1999), and Skemp (1976), teachers with common understanding of mathematics are informed by what society deems important to teach.

Understanding aligned with this perspective is said to be generated horizontally either from simple sources or locally known sources (Khoza, 2016). Bernstein (1999) dubbed this understanding horizontal knowledge. In education, most teachers have access to this type of understanding, manifesting it orally, using easy-to-understand language at the level of the majority of people in the society. Understanding of this nature has limited systematic principles and is segmentally differentiated. Segments do not bear any importance; furthermore, survival of this type of understanding is dependent on social relationship structures (Bernstein, 1999). In

this type of understanding conforming to societal affirmation is a norm; and ideas required for understanding a particular topic become basic for understanding many other topics (Skemp, 1976).

Cognisance is afforded to processes, tasks, and activities that become experienced through engagement (Kajander *et al.,* 2010). Furthermore, understanding is based on what teachers already know about mathematics, not by acceptance of academics on higher-order mathematical properties which teachers may not understand. Skemp (1976), a proponent of relational understanding, postulates that understanding is based on principles with more general applications by which children are given opportunities to explore on their own and interact with their environment using everyday language. For teachers to successfully implement curriculum, Kajander *et al.* (2010) claim that they only need understanding of 'maths for teaching', not mathematics that mathematicians value.

Individual understanding

Teachers who have individual understanding of implementing the curriculum are pragmatists who believe that aims of education are fluid. As life is dynamic, so aims of education, according to them, should also be the same. The aim of the pragmatic teacher is to develop the learner holistically. These teachers believe that education should prepare learners for practical life experiences; and their views promote hands-on activities. The teacher is regarded as a guide who provides learners with ample opportunities for natural development of their innate qualities. In this instance, the teacher's personal identity is needed to harmonise the professional and social identities (Khoza, 2021b).

Teachers must individually understand curriculum implementation: this is significant in igniting the reflective teachers within them. It may be concluded that teachers must reflect regularly to keep up with innovations in their field of teaching. According to Dewey (1933), reflections, for a teacher who has individual understanding of the curriculum, empower the individual with problem-solving abilities. Reflections are characterised by scaffolding of experiences and events that should be viewed as an active and deliberate cognitive process. These therefore allow teachers to reflect critically. Teachers driven by critical reflections, teach for individual reasons, with the aim of questioning and addressing certain other challenging issues, bringing about change (Galane, 2016). These teachers are, therefore, empowered to develop sufficient knowledge, skills, values, and attitudes to promote quality teaching (Khoza & Biyela, 2020). To promote quality teaching and critical thinking, teachers must understand mathematics curriculum content to be able to use their guiding framework for teaching and learning (Khoza & Biyela, 2020; and Makumane & Khoza, 2020).

Content

Content, as defined by researchers, is subject matter knowledge, skills, dispositions, understanding, and values that constitute a curriculum; content may be presented in many forms, including audio, text, and video (Berkvens *et al.*, 2014; Wood & Hedges, 2016; Mabuza, 2018). Content is knowledge selected into the curriculum and what learners are to be taught. Content is an essential resource; and to teach is to commit, whether consciously or unconsciously, to promoting knowledge vital for social reproduction and innovation, human development, and the flourishing of learners (Deng, 2010). Furthermore, when one engages in a discussion on classroom teaching, central to that discussion is content (Deng (2021). In countries where content is prescribed, such as in South Africa, curriculum developers decide on what should be taught and presented, prompting teachers to become experts in their subject fields (Hoadley & Jansen, 2013; Mabuza, 2018). Therefore, teachers have to be curriculum makers who must grapple with the intellectual and moral questions of content to be taught, why it should be taught, and how it should be taught within a particular classroom context (Deng, 2021). It should also be noted that prescribed content is one of the pillars of the performance curriculum and in performance curriculum, assessment is deemed important because it determines whether learning has taken place.

Assessment

Assessment is regarded as core, of central importance to education; and integral to teaching and learning in any formal school setting (Amua-Sekyi, 2016; Taras, 2005).Notwithstanding that assessment is core to teaching and learning, and that teachers are central to this activity, Taras (2005) and Newton (2007) note that there is no common definition and interpretation of assessment. Taras (2005, p. 467) defines assessment as "a judgement which can be justified according to specific weighted set goals, yielding either comparative or numerical ratings." On the contrary, Amua-Sekyi (2016, p. 1) defines assessment as "all activities that teachers and students undertake to get information that can be used to alter teaching and learning." Taras's (2005) definition generalises assessment as a judgement; and Amua-Sekyi's (2016) definition positions assessment as a remedy. The view of assessment as a remedy aligns with the use of assessment information to alter teaching and learning. Such may suggest that there are problems identified during the teaching and learning process which must be attended to. These contrasting definitions may be problematic, and may confuse teachers or other curriculum users who are not conversant with assessment matters, and do not understand that assessment can be used either to improve teaching or to assess learning. When it is used either to improve or alter teaching, it is known as *assessment for learning*; and when it is used as a judgement, it is called *assessment of learning* or summative assessment.

Learning Environment

A learning environment, as it is known and explained by researchers, is a location, an allocated space or a nurturing space in which teaching and learning take place (Head Start ECLKC, 2012; Adnan *et al.;* 2014; Ibem *et al.,* 2017). The learning environment is that in which teachers, learners, resources and facilities effectively interact; and one cannot function without the other (Adnan *et al.*, 2014; Mabuza, 2018). Bernstein (1999) concurs that, in a functional learning environment such as a classroom, there is a relation between

subjects, i.e., teacher-learner and learner-learner; between discourses, i.e., interdisciplinary, disciplinary, academic, and non-academic knowledge; and between spaces, i.e., teacher's space, learners' space, and spaces of different learners.

Pellegrino (2017) posits that learning environments that are effective are knowledge-centred, learner-centred, assessment-centred, and community-centred. There is a relationship between all components of a learning environment, i.e., the learning environment should be conducive to learning and assessment; it should be accessible to the wider school community, and should expose learners to knowledge.

However, Bernstein (1999), an opponent of learner-centredness, regards the learner-centred learning environment as a weak classification of a weak framing. There are no boundaries between learners of diverse social groups; which means that all learners share physical spaces and resources. Bernstein (1999) also believes that learner-centred environments produce horizontal knowledge. Teaching is not framed by rich content that produces school knowledge. The researcher's position is therefore aligned with teachers who have a common understanding of educational underpinnings.

Bernstein's narrative was, however, reversed during the COVID-19 pandemic: teachers had then to start using a remote learning environment to ensure that teaching and learning took place. There are a number of familiar online expert-aligned learning environments, also called learning management systems (LMSs) (Khoza, 2021b) that were mostly and are still being used both in basic education and higher-education institutions. These are Microsoft Teams (MsTeams), Zoom, Modular Object-Oriented Dynamic Learning Environment (MOODLE), WhatsApp, Google Classroom, Google Meet, Skype, radio and television (TV), to name a few. These platforms allow teachers, learners, parents, and other stakeholders to interact and communicate. Teachers can teach, post resources, set homework, provide pre-recorded videos, conduct live teaching, assess learners, and much more (Govender & Khoza, 2017; Khoza & Mpungose, 2017; Mpungose, 2018; Ramadani & Xhaferi, 2020; & Ružić-Baf *et al.*, 2021).

Those teachers who found it difficult to use the LMSs, opted for the Social Media Sites (SMSs) (Khoza, 2021a & b), these being cost-effective and easily accessible for many people. These SMSs, according to Khoza (2021a & b), are aligned with the competence-based DC promoting common understanding due to their ability to conduct educational actions or to achieve learning outcomes at basic or societally acceptable levels that promote societal identities. SMSs therefore gained momentum when they became examples of educational technologies used by higher education institutions (HEIs) and schools alike as part of the 4IR, especially during lockdown. However, as SMSs are not certified online learning platforms, teachers and learners were initially sceptical of using them, given the controversy over SMSs. For foundation phase learners it was worse, as many of these learners depended on their parents' devices to access the SMSs.

As alluded to earlier, the familiarity with both LMSs and SMSs gained momentum during the lockdown. In some institutions these sites had been used sporadically and were not fully accepted until the COVID-19 era (Khoza, 2021a). When COVID-19 rules were relaxed and learners started going to school using various models that suited the context of their environment, some institutions adopted the blended learning environments. Blended learning is the use of technology outside of the teaching time to complement face-to-face teaching. Such combines the societal and professional identities to produce the personal identity (Dockerty, 2020; Khoza, 2021b). Therefore, the blended learning environment combines the face-to-face and online learning environments. Mabuza (2018) agrees that the blended learning environment has its pillars as certified reflections of researched and approved methodologies, borrowing from both traditional and online environments.

The blended learning environment promotes self-directed learning and effectively provides flexible, timely, and continuous learning. This statement suggests that the blended learning environment is the best and most well-known option for selection by educational institutions to successfully deliver lessons, ensuring that teaching and learning takes place.

In the quest to make teaching and learning meaningful, teachers have exhausted the professional, societal, and their personal identities; for some it worked, but for others, it did not work and they failed. When teachers find themselves in this quandary, having tried and failed in everything, the NI comes to the fore. Through failure to produce positive results, no matter how hard they have tried, teachers begin to acknowledge the natural forces that have been enhancing their actions during the COVID-19 revolution. These actions are clearly and newly driven by nature (Khoza, 2021b).

Theoretical Framework: Natural Identity Framework (NIF)

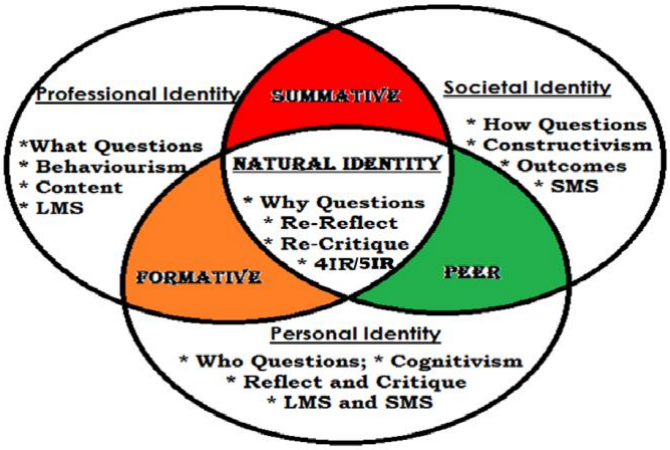

Figure 1: Natural Identity framework adapted from Khoza (2021b, p. 4)

The Natural Identity Framework (NIF)

According to Khoza (2021a, p. 16), natural identity "is the unconscious, subconscious and conscious cognitive process of believing that all actions and their outcomes are guided by natural laws, actions or forces". Thus natural identities comprise the professional, societal, and personal identities. Khoza maintains that, in differentiating these identities, teachers display their own way of interpreting what they value as quality. Khoza (2020) defines teacher identity as teachers' conscious thoughts that interrogate their subconscious thoughts. These subconscious thoughts drive teachers to know and understand their personal needs. The NIF suggests that for people to understand their natural identity, they must first understand their social and professional identities.

For societal identity, teachers depend on the definition given by the majority of teachers: that their value commitment is to society. On professional identities, quality education is about what the rules of the profession define and demand; and for the personal identities, quality education is what works for the individual person. This means that the individual has first to understand their personal needs and how these must be addressed; then to reflect and critique, thus positioning themselves on what works for them, not for the profession or the society. This whole process Khoza (2021a) theorised as a person's natural identity, which gave birth to the natural identity framework (NIF).

Khoza further advanced these three identities by creating links that connect them. The professional and societal identities are connected by the summative assessment which serves as a criterion to test whether learners have understood what they have been taught before their grading. Secondly, the societal and personal identities are connected by the peer assessment to help teachers individually to understand the various learning communities they engage with. The last connection for personal and professional identities is per the formative assessment. This connection enables teachers to establish required steps to improve educational practices, this being conducted before, during, and after the lesson (Khoza, 2021b). With these identities and their connections, the natural identity framework then emerged in the context of this study. How teachers identify themselves in the intended mathematics subject curriculum in Grade 3 determines their level of understanding of the curriculum at implementation level. This may either be at the expert, common, or individual level of understanding, as explicitly articulated in the natural identity framework.

Research and Methodology

Research Design

This study is a qualitative action research, using the pragmatic paradigm. Action research is commonly described as an investigation carried out by educators in their own contexts to improve their profession and to enhance the learning of their learners. Action research develops a solution that is of practical value to the people or organisations with whom the researcher is working, this being an interactive process (Bartlett & Burton, 2007; Asenahabi, 2019). Mills (2003) and Koshy (2005) add that action research works towards achieving practical outcomes, creating new forms of understanding and improvement of practice over a period of time. In the process, teachers are also empowered to develop a reflective practice and to improve on how they currently do things for better outcomes The purpose of conducting action research is that it gives the researchers an opportunity of critically observing a situation with the aim of improving the quality of action within, so that teachers can understand the practical situation, thus solve a particular problem and produce guidelines for better practice.

As a chosen paradigm for this study, pragmatism posits that research should be treated as a human experience based on the beliefs and actions of researchers, in this case, the researcher and teachers as participants. Furthermore, action research and the pragmatic paradigm work well together because both can be used in a qualitative study and may use either qualitative, quantitative, or mixed

methods (Shah, 2019). The main purpose of pragmatism is to reconcile both objectivism and subjectivism, facts and values, accurate and rigorous knowledge, and various contextualised experiences (Saunders *et al.,* 2019). This suggests that each person has own views on issues; however, these different views can be reconciled to strengthen and embrace the differences.

Therefore, pragmatists assert that human actions are informed by their past experiences and beliefs; and for this reason, it is difficult to separate experiences from beliefs. Meaning is derived from practical observable consequences and success in practice which is directly linked to experience; and these can be determined through their actions and intelligence (Creswell & Creswell, 2018; Kaushik & Walsh, 2019). The pragmatic paradigm uses mixed methods in research to understand human behaviour; therefore, it allows the researchers to adopt either a qualitative or quantitative approach, or both, to interrogate the phenomenon at hand (Kivunja & Kuyini, 2019 & Khoza, 2021b). Researchers tend to use a combination of different methods to address the research questions, e.g., intermingling of interviewing, observation, and document analysis (Kaushik & Walsh, 2019). Therefore, using a pragmatic paradigm action research, data will be analysed using the NIF and other generated data from reflective activities, interviews, observations, and the focus group of the sampled teachers.

For this study, purposive sampling is the most suitable, as the sampled Grade3 teachers are assumed to be the most suitable to answer the study's research questions. The relevance of using purposive sampling in this study is that all the sampled teachers are working for the Mpumalanga Department of Education, Nkangala District in KwaMhlanga. They are all teaching Grade 3 in various primary schools around the area. The sampled teachers were the most accessible at the time of the study.

Findings and Discussions

Findings of this study were informed by data generated from reflective activities, observations, semi-structured interviews and focus-group discussions. Data was then analysed in line with the categories presented in the table below, as informed by the NIF.

Table 1: Themes and Categories of Findings

Theme	Category
Theme One: Expert understanding (professional identity)	Specialised content Expert teacher roles Summative assessment Real-life learning environment and LMSs
Theme Two: Common understanding (societal identity)	Learner-centred teaching and learning activities Assessment for learning SMSs
Theme Three: Individual understanding (societal identity)	Teachers as researchers
Theme Four: Natural Identity	Re-reflection and re-critiquing their practice

Theme One: Expert Understanding

Content

Content, as defined by researchers, is subject matter knowledge, skills, dispositions, understanding, and values that constitute a curriculum; and may be presented in many forms, including audio, text, and video (Berkvens *et al.*, 2014; Wood & Hedges, 2016; Mabuza, 2018). Teachers therefore need to understand the unique nature of the mathematics content they teach. According to Carrillo-Yañez *et al.* (2018), specialised content understanding recognises the specialised nature of the teacher's mathematical understanding, which is exclusive to the teaching practice.

All participants, except for P2, when asked about their understanding of the content they were teaching, mentioned content that formed part of the mathematics CAPS document for the foundation phase. The content areas are numbers, operations and relationships; patterns, functions and algebra; space and shapes; measurement and data handling.

For example, P1, when asked about her understanding of content, said: *"… numbers and operations, Space and Shapes, Measurement and Data Handling, concrete objects, role play, fractions (practical activities given), using language of Measurement e.g. greetings in the morning."* Another participant mentioned the same and added similar topics to those of P3.

P3 explained that she teaches *"Data Handling, Measurement, counting, mental maths, and number operators. Every content is important and needs to be taught."*

In the two phases of reflections, observations, and interviews, findings on participants' understanding of the content they teach reveal that participants have various levels of understanding of the content that must be taught. However, when making reference to what needs to be taught all participants selected prescribed content from the mathematics CAPS.

It is evident that teachers understand content to be taught as the standardised content in the mathematics CAPS. However, teachers have limited understanding of its content-centred nature aligned with the performance curriculum.

According to Carrillo-Yañez *et al.* (2018), specialised content understanding recognises the specialised nature of the teacher's mathematical understanding, which is exclusive to the teaching practice. Therefore, teachers' foundational understanding of the mathematics curriculum content may be supported by the level of mathematics education they have achieved. In addition, Carrillo-Yañez *et al.* (2018) clarify that specialised content understanding is attributed to the quality of mathematics instruction. This is seen in literature findings: based on the teachers' varying levels of knowledge, their understanding of subjects may differ, and this may even influence how they teach. Each teacher has own beliefs, identities, and unique ways of interpreting mathematics. Actions are informed by the knowledge teachers bring to their practice, which translates to how they execute their roles (Güneş & Baki, 2012; Carpenter, Fennema & Franke, 1996, Moru *et.al.*,2014).

Expert teacher roles

The majority of participants in this study agreed, viewing themselves as transmitters of knowledge; without exception, they embarked on whole class teaching. Teachers were the ones teaching; learners were learning. It was also evident during observations that participants preferred traditional teaching methods. This suggests that they adopted the traditional methods of teaching.

P1: *"My role is to impart sound knowledge…to teach aspects in a manner that's not mundane."*

P6 understands his role *as "teaching and learning, assessment, support, recording and reporting."*

During observations also, throughout their lessons, teachers played the dominant teacher role. P4 and P6 sporadically gave learners an opportunity to come to the front, engaging in the lesson; however, learners did not initiate the activities.

Summative Assessment

All participants understand summative assessments as assessments that are administered and recorded; used to inform learners' promotion to the next grade.

P1, reflecting on her understanding of assessment, described assessment as *"…both formal and informal. Formal is from the CAPS and informal is classwork, homework and DBE book."*

P2: *"There are formal assessments and learners write them. Every week there is a test to check if they understood what was taught. I also assess them in class by giving them more work."*

According to Newton (2007), summative assessment characterises the nature of the assessment judgement on which a learner's knowledge, skills, and understanding are assessed. Mabuza (2018) likens summative assessment, specifically, to a court judgement, arguing that, after gathering all the evidence on what has been taught to learners, a judgement is made on whether the candidates are to be promoted to the next grade.

Real-life learning environment and LMSs

All six participants are teaching at ordinary public primary schools. The population of learners in all 5 schools is Black African only. P1, P2, P3, P4, and P5 have the same views on what comprises teaching at a school.

P1: *"I teach at a school. Teaching at school is better than teaching at home because it is guided by policies on content that is taught*."

P2: *"Formal environments work better because it is disciplined."*

P4: *"We teach in a classroom with the person in front of us."*

All teachers provided the same responses as P1 and P2 with regard to the school environment. They all agreed that a school is a place characterised by high morals, guided by policy, having regulated disciplinary measures, and where learners are safe. P4 added that when learners come to school, as teachers, they are able to help learners identify challenges that they may be facing. During the focus group, teachers still held same sentiments regarding the learning environment.

P6 also reflected that he teaches in a formal school environment, adding that *"…it is not important. I would also like if my learners were to explore. Some might benefit from coming to school every day and some will not. If the school could provide resources, then it will be beneficial to all learners."*

According to P6's account learners can still be taught and can learn outside the four walls of a classroom and outside the schoolyard. P6's statement also suggests that a school environment can only be beneficial, optimising learning, if it has adequate resources for this cause. In this phase, teachers made no mention of the online teaching and learning environment, but only the school as a learning environment.

In addition, Participants 1 to 4 admitted that they were not able to use the LMSs (online learning environment) during the lockdown because they were not prepared. Besides being unprepared, they had few or no skills in using the online learning environments. Challenges that they cited were lack of digital resources, and learners not having access to internet and devices. For these reasons,

teaching and learning did not take place during the lockdown. These findings are consistent with literature that learners from compromised backgrounds did not benefit from the online teaching due to their poor socio-economic backgrounds. The situation was aggravated by teachers who also had limited or no access to online platforms due lack of skills, no access to the internet, or lack of resources (Khoza and Mpungose, 2020; Mukute *et al.,* 2020; Alexander, 2020; UNESCO, 2021)

P4: *"People think if we don't have technology, we can't teach properly and that's not the case. If we don't have technology, especially with ESKOM right now, it tells us that whether you have a smart board or you have a blackboard, if Eskom decides to switch off, you're going to do old fashioned teaching."*

According to *P*5: *"Online teaching is not for everyone. During Covid-19, technology worked for some people and 90% of the people it didn't work for. Unfortunately, we are expected to achieve same outcomes, but the level, the playgrounds and on which we are playing is not the same. This is the reality of this country."*

Other participants agreed and added that online environments and teaching are not suitable for foundation phase learners. Technology cannot replace the teacher standing in front of the learners. It is evident that the challenges put forth by the participants were common to South Africa and elsewhere, confirming the challenges that teachers cited. Similarly, the researchers (An *et al*., 2021; Van Bergen & Daniel, 2022; Lucas & Vicente, 2022) posit that insufficient technological infrastructure, lack of technical equipment, poor digital skills, and redesigning and setting up of new learning scenarios, were among the main challenges that were experienced across the globe.

Theme Two: Common Understanding

Learner-centred teaching and learning activities

The findings of how teachers understand teaching and learning activities revealed that teachers all engaged in whole-class teaching. Participants explained that in their contexts, it is challenging to promote leaner-centredness because their classes are overcrowded. Literature found that, amongst other matters, overcrowding is a deterrent factor for quality of teaching and learning activities, learner performance, classroom management, teacher and learner motivation, and productivity (Durmuş, 2016; Ibem *et al.,* 2017; Sithole, 2017; Mabuza, 2018; Ndethiu *et al.,* 2020).

P1 said that *"I teach my learners…do class teaching and sometimes group teaching. Teaching them in a group give them opportunity to learn from others…individual teaching not possible because of overcrowding. There is no time and space to provide support"*. These sentiments are also held by P3 and P4.

Assessment for Learning

During interviews, participants acknowledged that they understand that in mathematics, they must administer both formal and informal assessments as per policy. Teachers also mentioned that they administer continuous assessment in Grade 3, using various forms of assessment.

P1: *"I assess my learners because we have to. I know assessment can be done orally or written to cover a diversity of learners."*

P2: *"After teaching, I have to know whether my leaners understood or not. I give my learners classwork and mark it. At the end of the week we, the three Grade 3 teachers, share our assessments that we did during the week, recap and improve our teaching. I also give them homework. …last week we did formal assessment…is a written assessment."*

P6: *"In terms of assessment, there are many ways to do the assessment… informal assessment and formal assessment. The informal I do in my classroom when I am observing, for example, in mathematics when they count. They also do written activities. I give them homework also, but when they bring it back you see that it is not the learner's handwriting. Their parents do it for them. The problem is that this conceals the learners' understanding of concepts taught."*

The findings indicated that all the participants understand that in the foundation phase informal assessment is to support and improve their teaching. Their position regarding the informal assessments, which are also called formative assessment or assessment for learning is consistent with findings from literature. Literature suggests that formative assessment is mostly used as part of a learning process, to gather learners' information; to improve pedagogy; to improve learner performance; and also as a diagnostic tool to assess the level of learners' knowledge and where teachers have to start teaching (William, 1999; Harlen and James, 2005, Ojuko *et al.,* 2013; Nortvedt, *et al.,* 2016; Rummanova *et al.,* 2020).

SMSs

To embrace their societal identities using the DC through SMSs, teachers in this study were aware of these SMSs and had long started using them for personal use, but not for teaching and learning. Findings from both observations and the two phases of reflective activities show that, even during the COVID-19 lockdown, for these teachers, teaching and learning did not take place; they did not have relevant resources for online teaching. Not only did they have no resources, but they also had no skills in using the online learning environment. This challenge is consistent with the findings of other studies regarding availability, accessibility, and utilisation of online learning environments and resources Khoza & Mpungose (2020).

However, during lockdown, only P2 was able to create WhatsApp groups for parents, sharing some lessons with them. The reason was that most of the parents of learners in P2's class are working, and have electronic devices and access to the internet in their homes. Therefore, it was not difficult to share activities on SMSs.

Theme Three: Individual Understanding

Teachers as Researchers

It was found that, of the six participants, only Participant 6 admitted that during the process of teaching, he is also learning. This was mentioned when P6 spoke of his roles as a teacher. Furthermore, when asked about his reasons for teaching, he stated: "… *I did research before I went to varsity. My research showed that Foundation Phase is problematic in Mathematics because learners do not get foundation form creche… The children are not well trained in mathematics. I went to pre- primary school and did research of what is the problem and found that the problem is the curriculum. Then I decided to go to university of Fort Hare to study foundation phase so that I can teach mathematics for learners to get knowledge and skills as without mathematics these learners cannot do anything. Maths is everything…we cannot live without maths. Yoh (sighs), if these children are not well taught sisenkingeni (we are in trouble) mam because the whole nation is doomed."*

P6's accounts reveal that he is not only driven by the expert or common understanding, but also by the individual understanding of his roles. After probing, during focus-group discussions, it was revealed that other teachers who were driven by individual rationale were open in their responses, justifying their reasons. According to P4, and P5, their current roles as teachers were informed by their experiences as a teachers, being a good teachers, hard workers, having a love for the job, and research conducted before studying further. However, being a good teacher may cover a wide range of activities, including knowing and understanding content, teaching the content well, and having a good relationship with learners or other stakeholders in education.

Theme Four: Natural Identity

Re-reflection and re-critiquing their practice

During the focus group, teachers were given the opportunity of re-reflecting and re-critiquing their practice so as to present solutions that would advance their natural understanding identity. Based on the findings, some teachers are neither guided by their expert (professional), common (societal), nor individual (personal) understanding/identities. Hence Khoza's (2021b) observation that humans, when engaged in certain activities, strive to achieve the best. However, when they fail to achieve due to factors beyond their reach, people believe that nature is responsible for enhancing or driving actions in the universe. Therefore, teachers' natural identity comes into play; and this is when teachers start re-reflecting and critiquing their practice. When re-reflecting, teachers' main concern was on content, believing that it negatively impacts their roles, how they teach and assess.

Adjusted content

Participants agree that the mathematics CAPS is a well-planned and organised curriculum; however, the content, concepts, and skills are too crowded, especially since the introduction of ATPs. It emerged from the findings that participants try to work hard thus keeping up with the demands of the system of education. However, as hard as they try, they are dissatisfied with being pushed into teaching mathematics simply for the sake of compliance; for this reason, teachers feel disempowered. Teachers acknowledged that mathematics CAPS is a good curriculum; nevertheless, it has many limitations for their practice. According to the participants, these limitations are caused by the people who support its implementation. Firstly, the DBE presented the ATPs that not only specify the core skills to be taught, but also during which week of the term they should be taught. Despite this being provided, the participants argue that it is not practically possible to teach more than one concept a week, especially when the concepts are from different content areas. The study therefore proposes that Grade 3 teachers be afforded the opportunity of using their natural understanding identity and available teaching time to complement the curriculum content requirements, without compromising quality.

The learning environment of choice

Findings revealed that participants were more comfortable using the real-life learning environment, such as a school. According to them the school is a natural setting that promotes learning in the safest and most accessible environment for all learners. The school also complements the type of resources they are using; the findings indicate that the participants only use concrete resources. However, participants also cited challenges regarding overcrowding and the poor state of their classrooms, which they argue impacts negatively on how they teach. Ibem *et al.*, 2017; Sithole, 2017; & Mabuza, 2018 concur that the state of the real-life learning environment impacts the effectiveness of teachers and the motivation of learners.

Based on the findings, participants do not use online resources; they did not use them during the COVID-19 pandemic. The only digital platform and resource that seemed to work while accessible for P2, P5, and P6 was the WhatsApp platform. Teachers find WhatsApp cost-effective and most used by many of the parents.

To date, WhatsApp has enabled teachers to communicate with parents, sharing some activities that learners can do at home. Because of the lack of digital platforms and resources, the study proposes that it should not be mandatory for teachers to use the blended learning environments. The Grade 3 learners, besides coming from poor socio-economic backgrounds, are still young to have and

use devices such as cellphones unsupervised. Therefore, teachers should first orientate the learners on the use of these resources in their classrooms.

Assessment

Findings from literature and the generated data indicated that assessment is an important curriculum element because it is used to evaluate whether learning has taken place. It was also revealed from the analysed data that teachers know that assessment is important; moreover, they understand that when assessing learners in mathematics they assess them on what they have taught them.

However, when participants re-reflected, it was revealed that they have a challenge in understanding why it is demanded that learners be assessed continuously in the foundation phase. Teachers argued that continuous assessment is time-consuming − it takes most of the teaching time and places them and their learners under unnecessary pressure. These participants admitted that they are expected to set a formal summative assessment task, taking into consideration the cognitive levels according to Bloom's taxonomy. However, they do not have the capacity for this. Hence, the teachers' preference is to be provided with readily available common assessments set by district subject specialists. The study proposes that, as teachers have both expert and common understanding of assessment, they should be afforded a platform on which to share their assessment practices, peer assessing one another's formal assessments tasks. This exercise may be important in teachers combining their experiences and expertise in assessment.

Time allocation

During reflections, teachers mentioned the challenges they had with the allocated teaching time for mathematics. Teachers are aware of the time allocation; however, it is a challenge for them to understand how the time should be distributed across the five content areas of mathematics when planning for teaching. The reason is that the time allocated for the teaching of mathematics should also be used for assessment.

The findings of this study are consistent with literature in that, while teachers grapple with their understanding identity, the time allocated for teaching mathematics is understood to be limited for a subject of this magnitude. Teachers with an expert understanding identity adhere to the allocated teaching time when planning their lessons, including assessments. Teachers using common understanding identities apply actual-time allocation, which is not rigid, but flexible. These teachers do not follow the rigid time allocated for mathematics, but teach to the needs of learners or as there is availability of time. As per the findings of this study, actual time may be more or less than the allocated time for teaching mathematics in the foundation phase. Those who assume an individual understanding identity utilise whatever time is available to teach mathematics. They do not adhere to the allocated teaching time as per CAPS or the actual teaching time for the teachers who adhere to the competence curriculum. Therefore, the study proposes that teachers utilise time for teaching and learning based on what works for them to avoid rushing the teaching of concepts and assessing for compliance.

Conclusions

Based on the findings from the initial stages of data generation, the study concludes that teachers' understanding of the implemented mathematics content in Grade Three is mostly informed by the expert, common, and individual understandings. It is argued that it is only through reflections that teachers are able to assume their natural identities: the three types of understanding do not always produce the desired results for teachers. Therefore, in this action research, during reflections, teaching practice, and discussions, teachers were able to speak out and to implement the curriculum informed by their individual understanding. This helped teachers to realise their natural identities. Teachers became autonomous; they implemented the curriculum the way it works best for them and their learners. The findings of this study may be beneficial to stakeholders in education, especially in countries where curriculum is prescribed, to relax the prescripts of subjects and allow teachers to be autonomous, then later evaluate the impact of this decision.

It should however be noted that, the limitation of these finding may be that, should teachers not engage in reflective practice, it may be difficult or not possible for them to adapt the content. Therefore, it will be beneficial for department of education to include teacher development programmes that promote reflective practice and teachers natural understanding identities. As curriculum components (objectives, content, teaching and learning activities, assessment, learning environment, accessibility, resources, teacher roles and time) cannot be dealt with in isolation, the study recommends that further studies be conducted to explore the teachers' natural understanding identity of the curriculum objectives. The reason is that objectives inform how content should be taught, what resources to be used and how to assess the prescribed curriculum content.

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