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Instructional time as social time: Teachers' curriculum literacy and expertise in teaching mathematics

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The study reported on here was conducted to explore four Grade 7 mathematics teachers' understanding of the relationship between the objectives indicated in the CAPS for teaching different topics/concepts and instructional time stipulated for doing so. Seven lessons were studied in 4 primary schools in the Vhembe district of the Limpopo province, South Africa. A constructivist philosophical approach was used. The data collection methods included interviews and classroom observations. The main finding indicates teachers' understanding of instructional time as either a regulatory or a teaching tool. The ability to translate instructional time into social time depends on the level of teachers' curriculum literacy. Consideration of how CAPS objectives could be fulfilled based on the topic/concept to be taught and the stipulated instructional time, influenced the learners' conceptual understanding, procedural fluency, and competency in mathematics. The conclusion underscores the importance of instructional time as both an essential authoritative regulatory tool and signal of a pedagogic device and communication required to advance the instructional objectives.

Keywords: curriculum literacy; instructional time; mathematics; objectives, teachers

Introduction

Stroh (2015) argues that learners, as social beings, cannot escape the process of interaction. As individuals and part of communities, they develop the ability to identify with or understand their perspectives, experiences or motivation and emotional state of other individuals and communities as they interact with them. Their subjectivity becomes embodied within collective perspectives. Also, according to Tummons (2018), it is the engagement and sharing of experiences that make classroom interactions joint/collaborative enterprises that are characteristic of every teaching and learning activity. However, since the engagement and sharing do not happen in a vacuum, but within a knowledge area, Brown (2017) describes learning mathematics as a mediated process of appropriation in which learners co-construct meaning as they participate in social activities during lessons. This makes the teaching and learning of mathematics a human activity. For this reason, Loc and Hao (2016) and Rowland (2003) regard such processes as embedded in historical, cultural, social, and experiential contexts.

The *Curriculum and Assessment Policy Statement* (CAPS) in South Africa describes mathematics as "a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves" (Department of Basic Education [DBE], Republic of South Africa [RSA], 2011:8). For example, in the Senior Phase (Grades 7–9), the CAPS requires a curriculum that creates opportunities for learners to

> work effectively as individuals and with teams; … communicate effectively using visual, symbolic and/or language skills in various modes; and demonstrate an understanding of the world as sets of related systems by recognising that problem-solving contexts do not exist in isolation (DBE, RSA, 2011:5).

Emphasising participation and communication at an individual and team levels requires learning or experiencing mathematics by doing it. Mathematics classrooms must be contexts within which learners are afforded time to interact and construct mathematical knowledge and their subjectivity as "budding" mathematics learners; thus, what makes subjects what they are, exists within contexts that they live in, where they come from, and those where they are headed. The subjectivity is, therefore, complex and multi-layered.

In Nealon and Giroux's (2012) view, the subject that is constructed by teaching and learning always explains pre-existing social conditions and categories. Learners bring their identities, individual capacities and social forms constructed and organised according to their cultures into the classroom. Therefore, to create useful teacher-learner relationships, they should be offered opportunities to engage in multiple references that are linked to different cultural codes, experiences, and languages. Giroux (1997) describes the type of implied pedagogy as border pedagogy.

Reyes (2005, cited in Garza, 2007:2) describes the pedagogy as "a knowledge base that educators need to consider increasing the academic achievement of diverse students in the border region." It (pedagogy) emphasises the construction of knowledge by individuals as they socially interact. It is in this sense that Reyes argues that the importance of the culture, context, custom and historical specificity that both learners and teachers bring into lessons should not be overlooked in selecting tasks and initiating teaching and learning activities/interactions.

Social Activities/Interactions and Learning

Heidegger (2019) considers true learning as a social process. He argues that it is in discursive interactions that learners observe the being of others, share their own being, reflect on it, and interpret and realise the logical procedures of other beings. The process results in the shaping and reconstruction of self-knowledge. Therefore, when social interactions are highly controlled, the non-sharing of experiences or being that prevails causes true learning to cease.

Since curriculum content is usually segmented into concepts that are to be taught during quantified periods of time, Slattery (1995:614) suggests that "educators are overwhelmed and frustrated as they try to …. accomplish … objectives with 'less and less' time, while also trying to be sensitive to the … public's demands for accountability." In his (Slattery, 1995:612) view, this time "has traditionally been incorporated into education as a variable that is controlled, managed or manipulated for the purpose of advancing instructional objectives, improving classroom management, and enhancing evaluation results." For this reason, he emphasises that "the key to liberating learning lies in unlocking time" (Slattery, 1995:616). However, this unlocking is not arbitrary. It should promote teaching and learning that is appropriate to the type of knowledge taught.

Bernstein (1996) argues that the underlying principles of transforming knowledge into pedagogic communication are informed or shaped by rules associated with the pedagogic device that must be used for communicating or teaching different knowledge types. He uses the concept of pedagogic device to describe the rules that should be used for the communication of educational knowledge or subject content. Bernstein (2003) asserts that it is through classification that differences between content and how it should be framed are made clear. Specialised interactional practices (legitimate relations of classroom communications) thus depend on the classification type of knowledge; that is, boundary maintenance between content areas. For example, for mathematics as strongly classified knowledge, specialised interactional practices frame and represent legitimate relations of classroom communication.

Framing as a concept refers to regulations of what may or may not be transmitted in the pedagogic relationship. Learners' interactions are regulated by rules that shape the legitimate processes of constructing both the recognition and realisation that make it possible for them (learners) to construct their own knowledge; in the case of this study, mathematical knowledge. For example, the recontextualization rules regulate the pedagogic discourses through organising the selected subject content, sequencing it as knowledge to be taught and learnt and pacing instruction to make the content accessible to the learners. The processes promote a relational understanding of concepts rather than instrumental understanding.

In the study that we conducted it was thus important to understand how, within the confines of the instructional time suggested to advance the objectives for teaching specific concepts, teachers were effective. It was important for them to help the learners reshape, remap, and reconstruct new mathematical knowledge and identities without being subverted by words in everyday language (Adler & Sfard, 2017; Xenofontos, 2016; Zepp, 1989).

Instructional Time

The physical or instructional time that is used to segment curriculum content into topics/themes/ concepts that are to be taught during periods that are usually indicated in a school timetable is crucial to the ways in which teachers plan and design their lessons and, therefore, the quality of teaching. Even though stipulated in material terms, when translated into tasks and activities/interactions, this physical time assumes a social character. The time can thus not be relived since it is "embedded in social interactions, structures, practices and knowledge and in artefacts, bodies and environment" (Adam, 2013:6). When this is the case, then it is no longer solely physical but social as well.

When physical time provides cues for the type of platforms or environments that need to be created, it becomes a critical resource for social interactions and learning experiences (Compton-Lilly, 2010; Go, 2012); it is multidimensional and significantly affects teaching and learning. Therefore, teachers in the study had to understand how the instructional time stipulated by the CAPS for the different topics could be translated into the social time required to achieve the set objectives. Since learners wittingly or not draw on their cultural and historical experiences and knowledge while trying to learn, this experience and knowledge constitute a platform for engagement between themselves as individuals, a class as a collective or community and the teacher. Prior knowledge and cultural capital need to be engaged with to maximise the meaningful development of conceptual understanding of the content taught.

The 2019 Trends in International Mathematics and Science Study (TIMSS) report highlights knowledge gaps in mathematics between South African learners and learners from other middle-income countries. It points out that only 41% of Grade 9 and 37% of Grade 5 learners had the basic subject knowledge and skills for the grades. The report links these knowledge gaps to the learners' location; poor and rural areas tended to perform poorly when compared to urban areas (see also Du Plessis & Mestry, 2019).

While Reddy, Arends, Harvey, Winnaar, Juan, Hannan, Isdale and Sekhejane (2022) link the Grade 9 Gauteng learners' 2019 TIMSS achievements in mathematics and science results to socioeconomic backgrounds and school contexts, West and Meier (2020) relate South African learners' poor performance to the overcrowded classrooms that are a result of the shortage of qualified teachers. According to Savides (2017), among the 5,139 teachers who are either unqualified or under-qualified in the education system, the majority are mathematics, science and technology teachers at all levels.

It is against this background that we explored how Grade 7 mathematics teachers in the Vhembe district understood and translated the CAPS objectives into teaching tasks and activities/interactions based on the stipulated instructional time. We wished to answer the following questions, "How do the Grade 7 mathematics teachers in Vhembe district understand the CAPS objectives?"; "What kind of tasks, activities/interactions do they use to teach prescribed concepts and skills within the stipulated instructional time?" and "How is the teachers' understanding of instructional time related to their curriculum literacy and expertise in teaching mathematics?"

In South Africa, studies on instructional time tend to focus mainly on how its use and management has affected teaching and learning (Bush, Joubert, Kiggundu & Van Rooyen, 2010; Hoadley, 2003; Schollar, 2008; Taylor, 2008). For example, Taylor (2008) explains how, among other factors, the failure of schools to start on time in the morning impacts teaching time and curriculum coverage negatively. Hoadley (2003) and Schollar (2008) looked at how instructional time was used in classrooms located in different socio-economic contexts and argue that its use was extremely slow, undifferentiated, and detrimental to curriculum coverage in working-class environments. Bush et al. (2010) explain how the generally poor instructional leadership in the schools that participated in their study compromised curriculum coverage, the learners' sound conceptual development, and consequently, contributed to poor learner performance. Other than, for example, Ndlovu (2014) and Ndlovu and Mostert's (2018) works on the use of a constructive approach to facilitate meaningful learning through, respectively, Realistic Mathematics Education (RME) principles and a Moodle platform, we could not trace studies that specifically focus on how instructional time impacts the teaching and learning of mathematics when used as social time. An exception is the recently published work by Mdaka, Modiba and Ndlovu (2023), in which instructional time is studied as "a teaching rather than a regulatory tool" (Mdaka et al., 2023:168).

Methodology

A qualitative case study design (Saunders, Lewis & Thornhill, 2009; Thomas & Myers, 2015) was used to study, firstly, the teachers' understanding of the objectives of the CAPS for Grade 7 mathematics and, secondly, the curriculum practices they used in lessons as real-life contexts. Furthermore, a constructivist philosophy approach or an interpretivist paradigm (Kamal, 2019; Merriam & Grenier, 2019; Ndlovu, 2021) that holds the view that people create their own meaning of social and psychological phenomena through interacting with the world was adopted. As they do so, they make sense of their experiences based on personal, historical, and societal perspectives.

Purposive sampling was used to identify schools in the Vhembe district of the Limpopo province with teachers who constituted information-rich cases (Babbie & Mouton, 2001; Saunders et al., 2009; Wagner, Kawulich & Garner, 2012) from whom the translation of instructional time into social time could be explored. These were teachers who were experienced in teaching mathematics and would be able to draw on their espoused theories of teaching and explain how they translated into tasks, activities, and classroom interaction issues (Seidman, 2019) important to the CAPS objectives based on instructional time.

To collect rich data to explore teachers' understanding of the relationship between the nature of mathematics as a knowledge area, CAPS/curriculum objectives for teaching Grade 7 mathematics and the instructional time for the different topics, document analysis (Heffernan, n.d.; Patton, 2015) was conducted to contextualise the study by making sense of the CAPS objectives and time suggested for teaching specific topics or content. Thereafter, to establish teachers' understanding of these aspects, interviews were conducted.

Pre and post-teaching interviews (Ha, 2004) were used to obtain teachers' understanding of the CAPS objectives. The teachers were expected to explain these objectives based on the subject content and the suggested instructional time, and then tease out the implications for designing lessons. The interviews were conducted at the schools in two sessions. Both were audio-recorded. The first was conducted before classroom observations of the first lesson and the second was conducted after the last lesson observation. This was to allow teachers to indicate their understanding of the objectives before teaching and then to witness their pedagogical practices (as lived experiences) and determine whether they were adequate and appropriate to address the concepts and principles implied in the objectives.

Data analysis started with the transcription of the recorded data. Transcribing allowed for the recognition of patterns and relationships that guided data coding, categories, and themes (Emerson, Fretz & Shaw, 2011). Research questions afforded identification of significant statements and the development of the themes that were directly related to the issues identified in the teachers' views on the CAPS objectives and classroom practices. Anonymity and trustworthiness and authenticity were criteria used for validation (Kivunja & Kuyini, 2017; Lincoln & Guba, 1985).

Findings

We first provide evidence that indicates how teachers understood the objectives proposed in the CAPS for Grade 7 and, therefore, their role as curriculum developers for mathematics. We then present the tasks and classroom activities/ interactions that teachers used for the suggested instructional time.

Teachers' Views on the Objectives for Teaching Grade 7 Mathematics

Exploring how the teachers understood the objectives stated in the CAPS, in particular, their implications for curriculum development, indicated that they were aware of the importance of using real-life experiences or realistic models to make mathematical concepts and problems imaginable for learners. For example, according to Teacher 4: "*When learners are supposed to acquire the concepts and skills stipulated in CAPS such as ordering, comparing, and simplifying fractions, calculation of percentages and equivalent forms of fractions; not observing them in real life can compromise understanding*.".

It was also important for Teacher 3 to use teaching aids that were suitable for concepts and skills implied in the objectives. Here is an excerpt from the interview with him/her:

> *I just use what we can all observe. For example, this week's topic that requires learners to be able to classify 3D* [three-dimensional] *objects and know how to identify the different objects … they have to know what to look for in identifying the faces under each 3D object ... also, the edges, even the vertices and, they can also identify these things, using a house as example does help to understand the 3D concept.*

When invited to explain why real-life examples were important to the CAPS objectives, teachers seemed to understand the objectives in a literal sense rather than cognitively. There was no critical reflection nor reference to how examples addressed the essence of the set objectives. For example, in responding to the question: *"*How are the real-life examples made relevant to the CAPS objectives?", instead of addressing the link between real-life examples they referred to and the essence of the objectives, teachers used the instructional time to explain their choices of real-life objects and activities to include in lessons. In doing so, they highlighted the significance of the time for staying on course, ensuring that they dealt with all the prescribed subject content and when to start preparing the learners and get them ready for the formal assessment/examination.

The Significance of Instructional Time to the Activities and Tasks that Teachers Used in Lessons

Teacher 2 indicated that knowing the allocated time for each topic helped when planning what to do in the lessons and deciding how much learner engagement should be allowed to finish teaching the prescribed content in the suggested time.

> *Learners will be exposed to different examples and types of activities in their everyday lives depending on the time allocated by the CAPS to teach a topic. The time helps me not to stay on one topic for longer than it is necessary … I should be able to cover the whole topic, finish and still assess learners in this time.*

Teacher 4 highlighted the same point as follows:

> *Learners have to understand the concepts and skills taught in the time prescribed in the CAPS policy. Planning lessons with this in mind also helps in designing lessons wherein examples from learners' contexts and activities are pre-planned rather than allow them to happen suddenly during lessons.*

For Teacher 3 the stipulated instructional time in the CAPS was a resource for curriculum decision-making. S/he explained:

> *The time allocated … assists me to select activities that are relevant, and learners can relate to and that will not make me waste time. It is important … when I make decisions about the objects that I usually distribute during the lessons, for example, different shapes, encourage the learners to interact and discuss … so as not to waste … time allocation … gives us direction.*

Teacher 1 simply said:

> *We cannot change what CAPS suggests because it is our guide for how to cover all the work well, that is, pace curriculum coverage. But in an overcrowded school like this one, … you might end up not covering the curriculum. So, I prioritise teaching the subject content and allow very little examples as interruptions … until I feel that … I'm covered.*

To probe further, the teachers were asked to indicate what they were able to achieve with the activities, tasks, and objects that they used in their teaching. In response to the question: "What have you achieved with the tasks, activities/interactions you used for teaching mathematics to Grade 7 learners?" they focused on how they used teacher-directed activities and tasks, learner-focused teaching, and the value of what they did. Teacher 2 commented:

> *When I use examples and activities to teach, I want learners to know, for example, in the case of*

> *this week, different types of graphs and help each other identify them. I want them to know how to refer to the features and trends of global graphs, such as increasing, decreasing, constant and linear and non-linear. For example, the word 'constant' means not changing. ... as I said in class, If, let's say I give you a test. First test you get 40%, second test 40%, third test 40%, which means your marks are?*
> Class*: not changing.*
> Teacher 2: *but if I give you the 1st test 15%, second test 35%, third test 55%. It means they are…?*
> Class: *Increasing.*
> Teacher 2: *always use examples to help each other by explaining to those struggling.*

The classroom observation revealed the following for Teacher 3.

> *Yes, if it's a flat surface it means we need to know how we can identify those faces. When we talk about the face, it's like your face as a person. So, when we identify the faces, we need to think, we use ... imagination to think beyond what you are not seeing. For example, when I used the box, you were only able to see the front face. But for mathematics, you need to think, as you know that the box has got many sides. 'How many sides do we have here?'*
> Learners: *Six sides.*

The same applied in Teacher 1's lesson on graphs:

> *The dependent can be changed and the independent cannot be changed. If you usually come to school from home at 20 past 7, can the distance between your home and school change if you arrive at 7?*
> Class: *No.*
> Teacher 1: *What about the traveling time?*
> Class: *It can change.*

Discussion: Teachers' Understanding of Instructional Time, Curriculum Literacy and Expertise in Teaching Mathematics

Analysing the CAPS unveiled the implications of its objectives for curriculum development, the instructional time allocated and suggested teaching strategies. However, in explaining the objectives, teachers seemed to pay attention to teaching and learning aids rather than the learning environment or platform required to fulfil the objectives. The teachers did not refer to how the real-life examples supported, for example, the organising principles of an objectives-driven curriculum, namely, specificity, unambiguity and measurability that they were teaching. Neither did they explain how using concrete and symbolic representations helped to unravel mathematical abstraction processes. It was important to illustrate the value of starting at the situational or context level to the learning process, in particular, applying domain-specific situational knowledge and strategies in solving experientially real problems. Based on the evidence in the study, the teachers' understanding of the CAPS objectives could be described as having fallen short of a proper grasp of the relationship between empirical evidence and mathematical concepts (Mitchelmore & White, 2004).

According to Mitchelmore and White (2004), teaching mathematics should go beyond the use of real-life examples. It must help learners understand concepts through procedures and principles that enable them to function at an abstract level. Learners' inabilities to compute answers to questions can thus be traced to challenges in grasping legitimate procedures and principles needed to recognise patterns in the taught exemplar tasks (Benis-Sinaceur, 2014; Mitchelmore & White, 2004). Becoming familiar or recognising parts/components of some aspects of a material reality and studying their underlying mathematical structure, does not, in Mitchelmore and White's (2004) view, imply an understanding of mathematical concepts. It is only by drawing on previous concepts or images or inserting a new discourse into an existing one that learners begin to develop new concepts based on this existing or prior specific knowledge. Existing knowledge will be understood and acknowledged, provided an ability to step outside of it, critically use it, and creatively and appositionally reconstruct it is evident. Therefore, in explaining the CAPS objectives, it would have been helpful for the teachers to select an objective as example, reflect on it, highlight its behavioural implications and explain how they could be achieved using concepts and procedures and principles that would enable learners to function on an abstract level when taught specific subject content. Overlooking these qualities or features (Adler & Sfard, 2017; McAteer, 2013) of mathematics concepts in explaining the CAPS objectives made teachers' conceptions incomplete.

Real-life tasks, activities and interactions ought to have been explained based on the suggested teaching approaches in the CAPS rather than solely in terms of the stipulated instructional time. According to Bernstein (2003), the allocation of time to content primarily refers to specialised interactional practices that need to regulate legitimate relations of classroom communication. Pedagogic communication should enable the recognition and realisation of educational knowledge by regulating relevant meanings and how to relate or put them together to create a legitimate text. Since learners need to be assisted to recognise the categories of the content taught and realise the specific procedures applicable to such content, as they interact with the teacher and each other displaying their being (Heidegger, 2019) during lessons, teachers should be aware that the language used in the CAPS (action verbs) such as investigate, analyse, develop, interpret, among many, implies a pedagogic discourse. It indicates the interactive, intersubjective social platforms that are needed for sharing experiences and meaning.

Therefore, such a pedagogic discourse in mathematics classes, which is often teacher-focused, will reflect, at first, legitimate and peripheral participation. However, the varied discursive interactions are likely to foster the crossing of borders as repertoires are shared. Continued mutual engagement or social activities between the teacher and learners plant the seeds for joint enterprises (Tummons, 2018) as teachers and learners work together and draw on the habits, discourses, routines, ways of talking, tools, structures, and other artefacts As borders of the different beings are crossed (Giroux, 2004), the social time (Compton-Lilly, 2010; Go, 2012) will facilitate self-knowledge in relation to other beings, that is, the class. An individual learner will interpret other individual experiences and realities and develop their understanding based on the values, codes, rules, and meanings taught by the teacher as representative of the mathematics community to which they belong. The shared repertoire and interpretation of different experiences during the mutual engagement is likely to result in enterprises that are inclusive and make for easy self-knowledge and the internalisation of new knowledge. Yet, the teachers seemed unaware of the importance of the link between subject content, objectives and instructional time as pointers to a pedagogic device that Giroux (1997, 2004) calls “border crossing.”

In Giroux’s (2004) view, border crossing happens as teachers and learners interpret the experiences and realities of others and develop their own understanding based on the values, codes, rules, and meanings that are relevant to a knowledge area. For him, “pedagogy is not simply about the social construction of knowledge, values, and experiences; it is also a performative practice embodied in the lived interactions among educators, audiences, texts, and institutional formations” (Giroux, 2004:61). As interactions occur among teachers, learners, texts, and institutional formations in lessons, they are engaged with and negotiated to understand the boundaries or limits of individual knowledge, interpret the experiences and realities of others, and develop understanding based on the values, codes, rules, and meanings relevant to a knowledge area.

As argued earlier, Heidegger (2019) views learning as a social process that depends on intersubjective relations making learning a social rather than an individual process. To be authentic it has to be composed of the character of other factors, human and non-human, as well. All four teachers in the study understood that the CAPS should be supported through real-life examples. However, they seemed unaware that the pedagogic significance of the objectives could not be explained in isolation to the concepts, principles and procedures implied in the action verbs. The significance of the examples related to the objectives was mainly understood in terms of instructional time but only in a physical and not a social sense.

The teachers were also aware that the time allocated for teaching mathematics content gave them some professional authority and responsibility to design activities (social engagement and interactions) that scaffolded learning. Therefore, as part of their curriculum literacy, their views on the CAPS objectives and examples they gave, demonstrated a limited grasp of the importance of the translation process from the concrete world to an abstract one and mediation that is crucial to recontextualising the actions verbs in the language used in the CAPS objectives.

Concluding Remark

The findings reported on here seem to further support the concerns raised by, among others, the TIMSS report of 2019 and Reddy et al. (2022) about the general competence of South African mathematics teachers as curriculum developers. In explaining the CAPS objectives, the teachers seemed to pay more attention to describing the purpose of the teaching aids they used. The aids were also accounted for and linked to instructional time. Implications for learners’ cognitive development were not grasped. Specifically, in the case of this study conducted in the mainly rural province of Limpopo, the findings highlight the desperate need to improve teachers’ knowledge, expertise and curriculum literacy. As Mogari (2014:3) argues, there is a need for effective teacher education that promotes “activity-oriented teaching that focuses on the mastery of mathematics content and induces affinity through relevant real-life activities that are familiar to learners.” Otherwise, learners will continue to perform poorly in mathematics and academic success will remain elusive to many.

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Authors’ Contributions

MJM and MM conceptualised the study; MJM conducted the fieldwork, MM structured the article; MJM worked on first draft; MM reviewed the first and subsequent drafts and both authors reviewed the final manuscript and revisions requested.

Notes

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References

Adam B 2013. *Timewatch: The social analysis of time*. London, England: John Wiley & Sons.

Adler J & Sfard A (eds.) 2017. *Research for educational change: Transforming researchers' insights into improvement in mathematics teaching and learning*. London, England: Routledge.

Babbie ER & Mouton J 2001. *The practice of social research* (8th ed). Oxford, England: Oxford University Press.

Benis-Sinaceur H 2014. Facets and levels of mathematical abstraction. *Philosophia Scientiæ*, 18(1):81–112. https://doi.org/10.4000/philosophiascientiae.914

Bernstein B 1996. *Pedagogy, symbolic control and identity: Theory, research, critique*. London, England: Taylor & Francis.

Bernstein B 2003. *Class, codes and control: The structuring of pedagogic discourse* (Vol. 4). East Sussex, England: Psychology Press.

Brown R 2017. Using collective argumentation to engage students in a primary mathematics classroom. *Mathematics Education Research Journal*, 29(2):83–199. https://doi.org/10.1007/s13394-017-0198-2

Bush T, Joubert R, Kiggundu E & Van Rooyen J 2010. Managing teaching and learning in South African schools. *International Journal of Educational Development*, 30(2):162–168. https://doi.org/10.1016/j.ijedudev.2009.04.008

Compton-Lilly C 2010. *Making sense of time as context: Theoretical affordances of chronotopes in the study of schooling and school success* (WCER Working Paper No. 2010-11). Madison, WI: Wisconsin Center for Education Research, School of Education, University of Wisconsin–Madison. Available at http://eric.ed.gov/?id=ED511803. Accessed 7 June 2022.

Department of Basic Education, Republic of South Africa 2011. *Curriculum and Assessment Policy Statement Grades 7-9 Mathematics*. Pretoria: Author. Available at https://www.education.gov.za/Portals/0/CD/National%20Curriculum%20Statements%20and%20Vocational/CAPS%20SP%20%20MATHEMATICS%20GR%207-9.pdf?ver=2015-01-27-160141-373. Accessed 20 May 2024.

Du Plessis P & Mestry R 2019. Teachers for rural schools – a challenge for South Africa. *South African Journal of Education*, 39(Suppl. 1):Art. #1774, 9 pages. https://doi.org/10.15700/saje.v39ns1a1774

Emerson RM, Fretz RI & Shaw LL 2011. *Writing ethnographic fieldnotes* (2nd ed). Chicago, IL: University of Chicago Press.

Garza E 2007. Becoming a border pedagogy educator: Rooting practice in paradox. *Multicultural Education*, 15(1):2–7. Available at http://eric.ed.gov/?id=EJ780587. Accessed 12 June 2022.

Giroux HA 1997. *Pedagogy and the politics of hope: Theory, culture, and schooling; a critical reader*. London, England: Westview Press.

Giroux HA 2004. Cultural studies, public pedagogy, and the responsibility of intellectuals. *Communication and Critical/Cultural Studies*, 1(1):59–79. https://doi.org/10.1080/1479142042000180926

Go N 2012. Temporality and emergences in education. *KronoScope*, 12(2):171–184. https://doi.org/10.1163/15685241-12341243

Ha PV 2004. Classroom observation as a tool for professional growth. *Teacher's Edition*, 5:26–30. Available at http://www.nzdl.org/gsdl/collect/literatu/index/assoc/HASHca5a.dir/doc.pdf. Accessed 13 May 2024.

Heffernan C n.d. *Document analysis*. Available at https://www.drcath.net/toolkit/document-analysis. Accessed 10 May 2024.

Heidegger M 2019. *Being and time*. Eastford, CT: Martino Fine Books.

Hoadley U 2003. Time to learn: Pacing and the external framing of teachers' work 1. *Journal of Education for Teaching*, 29(3):265–277. https://doi.org/10.1080/0260747032000120141

Kamal SSLBA 2019. Research paradigm and the philosophical foundations of a qualitative study. *PEOPLE: International Journal of Social Sciences*, 4(3):1386–1394. https://doi.org/10.20319/pijss.2019.43.13861394

Kivunja C & Kuyini AB 2017. Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, 6(5):26–41. https://doi.org/10.5430/ijhe.v6n5p26

Lincoln YS & Guba EG 1985. *Naturalistic inquiry*. London, England: Sage.

Loc NP & Hao MH 2016. Teaching mathematics based on "mathematization" of theory of Realistic Mathematics Education: A study of the linear function Y=Ax+B. *The International Journal of Engineering and Science (IJES)*, 5(6):20–23.

McAteer M (ed.) 2013. *Improving primary mathematics teaching and learning*. Berkshire, England: Open University Press.

Mdaka MJ, Modiba M & Ndlovu M 2023. Social time as a pedagogical toll for meaningful mathematics teaching and deeper learning. *Mathematics Teaching Research Journal*, 15(2):165–181. Available at https://commons.hostos.cuny.edu/mtrj/wp-content/uploads/sites/30/2023/06/9Mdaka-South-Africa-1.pdf. Accessed 8 May 2024.

Merriam SB & Grenier RS 2019. *Qualitative research in practice: Examples for discussion and analysis*. San Francisco, CA: John Wiley & Sons.

Mitchelmore M & White P 2004. Abstraction in mathematics and mathematics learning. In MJ Hoines & AB Fuglestad (eds). *Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 3). Bergen, Norway: Bergen University College. Available at https://files.eric.ed.gov/fulltext/ED489589.pdf. Accessed 23 May 2024.

Mogari LD 2014. A global perspective of mathematics teaching: Implications for South Africa [Inaugural lecture]. University of South Africa. 28 August. Available at http://uir.unisa.ac.za/handle/10500/19003. Accessed 9 June 2022.

Ndlovu M 2014. The effectiveness of a teacher professional learning programme: The perceptions and performance of mathematics teachers. *Pythagoras*, 35(2):Art #237, 10 pages. https://doi.org/10.4102/pythagoras.v35i2.237

Ndlovu M 2021. Paradigms in mathematics teacher professional learning research: A review of South Africa's literature for 2006–2015. In K Luneta (ed). *Mathematics teaching and professional learning in sub-Sahara Africa.* Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-030-82723-6_11

Ndlovu MC & Mostert I 2018. Teacher perceptions of Moodle and throughput in a blended learning programme for in-service secondary school mathematics teachers. *Africa Education Review*, 15(2):131–151. https://doi.org/10.1080/18146627.2016.1241667

Nealon J & Giroux SS 2012. *The theory toolbox: Critical concepts for the humanities, arts, & social sciences* (2nd ed). Plymouth, England: Rowman & Littlefield.

Patton MQ 2015. *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed). London, England: Sage.

Reddy V, Arends F, Harvey J, Winnaar L, Juan A, Hannan S, Isdale K & Sekhejane P 2022. *The Gauteng province TIMSS 2019 Grade 9 results: Building achievement and bridging achievement gaps*. Cape Town, South Africa: HSRC Press. Available at https://repository.hsrc.ac.za/bitstream/handle/20.500.11910/19474/9812400.pdf?sequence=1&isAllowed=y. Accessed 24 May 2024.

Rowland T 2003. Mathematics as human activity: A different handshakes problem. *The Mathematics Educator*, 7(2):55–70. Available at https://nrich.maths.org/content/id/11016/Mathematics%20as%20Human%20Activity.pdf. Accessed 30 April 2024.

Saunders M, Lewis P & Thornhill A 2009. *Research methods for business students* (5th ed). Harlow, England: Financial Times Prentice Hall.

Savides M 2017. South African schools have 5,139 teachers who are unqualified or under-qualified. *Times LIVE*, 6 June. Available at https://www.timeslive.co.za/news/south-africa/2017-06-06-south-african-schools-have-5139-teachers-who-are-unqualified-or-under-qualified/. Accessed 10 May 2022.

Schollar E 2008. *Final report of the Primary Mathematics Research Project*. Paper presented at the Conference What's Working in School Development, Boksburg, South Africa, 28–29 February.

Seidman I 2019. *Interviewing as qualitative research: A guide for researchers in education and the social sciences* (5th ed). New York, NY: Teachers College Press.

Slattery P 1995. A postmodern vision of time and learning: A response to the national education commission report *Prisoners of Time*. *Harvard Educational Review*, 65(4):612–634. https://doi.org/10.17763/haer.65.4.0908t56382151541

Stroh KM 2015. Intersubjectivity of Dasein in Heidegger's *Being and Time*: How authenticity is a return to community. *Human Studies*, 38(2):243–259. https://doi.org/10.1007/s10746-015-9341-9

Taylor N 2008. *What's wrong with South African schools.* Paper presented at the Conference What's Working in School Development, Boksburg, South Africa, 28–29 February. Available at https://www.jet.org.za/resources/Taylor%20Whats%20wrong%20with%20SA%20schools%20JET%20Schools%20Conf%20final.pdf. Accessed 24 May 2024.

Thomas G & Myers K 2015. *The anatomy of the case study*. London, England: Sage.

Tummons J 2018. *Learning architectures in higher education: Beyond communities of practice*. London, England: Bloomsbury Academic.

Wagner C, Kawulich BB & Garner M 2012. *Doing social research: A global context*. Berkshire, England: McGraw-Hill Higher Education.

West J & Meier C 2020. Overcrowded classrooms – The Achilles heel of South African education? *South African Journal of Childhood Education*, 10(1):a617. https://doi.org/10.4102/sajce.v10i1.617

Xenofontos C 2016. Teaching mathematics in culturally and linguistically diverse classrooms: Greek-Cypriot elementary teachers' reported practices and professional needs. *Journal of Urban Mathematics Education*, 9(1):94–116. Available at https://eric.ed.gov/?id=EJ1108453. Accessed 14 May 2022.

Zepp R 1989. *Language and mathematics education*. Hong Kong, China: API Press.