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Regular Article

Utilizing Bloom's taxonomy and authentic learning principles to promote preservice teachers' pedagogical content knowledge

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ABSTRACT

The global reading crisis has been widely reported. One of the reasons attributed to the reading crisis is teachers' inadequate pedagogical content knowledge (PCK) regarding the teaching of reading. In South Africa, a multilingual country, the reading dilemma and the need for improved PCK have been debated extensively. This study, therefore, explores how utilizing Bloom's taxonomy and authentic learning principles within teacher education can promote the development of PCK in teaching reading. Using an interpretivist paradigm and an exploratory qualitative research design, data were collected from 20 second-year preservice teachers. The data collection consisted of a qualitative open-ended reflection questionnaire and document reviews. Inductive and thematic analysis was used for data analysis. The findings highlight the importance of authentic learning and PCK in teacher education and training. Furthermore, the findings indicate how Bloom's taxonomy can serve as a possible metacognitive framework to promote preservice teachers' PCK development. The benefits and challenges of PCK within teacher education are also elaborated on. Recommendations are made for teacher education programs to explore the value of Bloom's taxonomy as a metacognitive learning framework instead of a hierarchical assessment framework to create authentic learning opportunities to better prepare preservice teachers for practice.

1. Introduction

Literacy, specifically reading skills, has been declared a global crisis. The Global Education Monitoring Report of the United Nations Educational, Scientific and Cultural Organization (UNESCO and Global, 2020) and the Program for International Student Assessment (UNESCO International Bureau of Education, 2023) highlight the large number of adults lacking basic literacy skills, with an estimated 773 million adults worldwide being illiterate. Attention is specifically drawn to the challenges in achieving desired reading competencies in many countries (Organization for Economic Co-operation and Development, 2021). In the latest Progress of International Reading Literacy Study report of 2021, it was found that 81% of South African learners could not read for meaning (Department of Basic Education (South Africa), 2023). National assessment reports, such as the Early Graded Reading Assessment, have also reported on the alarming reading skills of Foundation Phase learners (Grades R to 3, ages 5 to 9) in South Africa (Dubeck & Gove, 2015; Gauteng Provincial Department, 2018; Hungi, 2011; Organization for Economic Co-operation and Development, 2021; Spaull, 2011; Taylor, Cilliers, Prinsloo, Fleisch, & Reddy, 2019).

Several reasons have been attributed to learners' poor literacy (i.e., reading) results, such as poor socioeconomic circumstances (Department of Basic Education (South Africa), 2023; Howie et al., 2017; Mohangi, Krog, Stephens, & Nel, 2016), overcrowding in classrooms (Cilliers & Bloch, 2018; West & Meier, 2020), a lack of reading material (Cilliers & Bloch, 2018; Mullis, Martin, Foy, & Hooper, 2017), the language of learning and teaching not being their mother tongue (Plüddemann, 2015; Potgieter et al., 2017), a lack of parental involvement and an unsupportive home environment (Howie et al., 2017; Taylor, Sithole, & Mayer, 2014). Poorly trained teachers have also been associated with high learner dropout rates and poor literacy achievement (Department of Basic Education (South Africa), 2023; Department of Education (South Africa), 2008; Pretorius, Jackson, McKay, Murray, & Spaull, 2016; Taylor, 2014; Uwatt & Egbe, 2011).

Insufficient teacher training on teaching reading is contributing to teachers' limited pedagogical content knowledge (PCK) (Charter, 2016; Gains & Graham, 2011; Taylor, 2016). PCK refers to the ability to combine content knowledge in a specific domain or subject area with sound pedagogical and methodological approaches that foster meaningful learning (Saubern, Urbach, Koehler, & Phillips, 2019; Shulman,

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1986a; Shulman & Shulman, 2004). Pretorius and Klapwijk (Pretorius & Klapwijk, 2016) describe the lack of PCK regarding teaching reading as teachers not having a clear understanding of reading concepts, reading development and reading methodology. Teacher education, training programs and curricula in South Africa are held partly responsible for teachers' inadequate PCK (Goodman et al., 1991; Korthagen, 2001; Malda, Nel, & van der Vijver, 2014; Naidoo, Reddy, & Dorasamy, 2014; Taylor, 2014). The problem possibly lies in teacher education programs that often have limited authentic learning opportunities, mainly focusing on theoretical principles of teaching reading (Goodman et al., 1991; Lombardi, 2007; Roach, Emanuela, & Mitchell, 2018a).

To fully equip South African preservice teachers with the necessary PCK to teach reading, teacher education programs must also prepare them to deal with the complexities surrounding the multilingual context, where children are often taught how to read in a language other than their mother tongue. This is a challenging task for most higher education institutions, as their preservice teachers are often also studying in a language that is not their mother tongue.

Owing to research arguing that teacher education programs are not sufficiently equipping preservice teachers with the necessary PCK for the teaching of reading in a multilingual context, this study explored how the design of reading programs at the undergraduate level can address preservice teachers' PCK by adhering to the principles of Bloom's taxonomy and authentic learning. The three research questions of the study were as follows:

- How can the design of reading programs better prepare preservice teachers for the teaching of reading?
- What are the benefits of designing reading programs at the undergraduate level as part of the Bachelor of Education curriculum?
- How can collaboration between Bloom's taxonomy and authentic learning principles enhance preservice teachers' PCK?

2. Background

In the 21st century, teacher education is one of the most pressing issues in educational research, as it addresses complicated topics about how preservice teachers are being prepared, or rather, should be prepared for practice (i.e., multilingual realities of the classroom). What types of knowledge and pedagogies are they exposed to within their programs and curricula, and how is theory transferred to practice? In a report by Taylor (Taylor, 2014), he raises the following two questions: To what extent does teacher education meet the demands of schools? And are we producing teachers who are able to address the challenges of schooling? These questions are especially relevant in South Africa and are at the forefront of policy transformation agendas worldwide (Chisholm, 2019).

Associations between poor learner performance and underqualified, or ill-equipped, teachers have been reported in various studies (e.g., Department of Education (South Africa), 2008; Uwatt and Egbe, 2011; Goodman et al., 1991; Korthagen, 2001; Malda et al., 2014; Naidoo et al., 2014). However, it is argued that poor learner performance does not begin with teachers but with the teacher education programs that prepared them for practice (Charter, 2016; Chisholm, 2019; Cilliers & Bloch, 2018; Pretorius et al., 2016; Taylor, 2014; van der Berg, Spaull, Wills, Gustasfson, & Kotze, 2016). Teacher education worldwide, but specifically in South Africa, is criticized for failing to prepare preservice teachers for the realities of the classroom, and, in South Africa, for not meeting the national required standards as set out in the *Minimum Requirements of Teacher Education Qualifications* framework developed by the Department of Higher Education and Training (Department of Higher Education and Training (South Africa), 2015). Teacher education programs are criticized for creating a theory–practice gap (West & Meier, 2016), which leaves preservice teachers ill-equipped for teaching reading (Department of Education (South Africa), 2008; Malda et al., 2014; Naidoo et al., 2014). The theory–practice gap refers to the many instances where there is hardly any, if at all, transfer of theory (i.e., theoretical information about the teaching of reading) to practice (Department of Education (South Africa), 2008; Goodman et al., 1991; Korthagen, 2001; Malda et al., 2014; Naidoo et al., 2014; West & Meier, 2016). The theory–practice gap is aligned with the reality shock (Mugaloglu & Doganca, 2009; Ünver, 2014) that beginner teachers experience because of the unmet expectation that they "will successfully transition from a theory-orientated preservice-teacher to a well-rounded practice-based teacher within the first few years of employment" (Botha & Rens, 2018).

When South African learners' poor reading skills and the existence of a theory–practice gap within teacher education are considered, there is a strong motivation for increased focus on PCK in teaching reading, owing to the focus of PCK on the amalgamation of content and pedagogy (Phatudi, Joubert, & Harris, 2014; West & Meier, 2016). Therefore, to break the cycle of poor learner performance in reading and to improve teacher education, higher education institutions must provide preservice teachers with sufficient PCK (i.e., practical experiences, tools and strategies) that will equip them to integrate theoretical content knowledge with pedagogical approaches in order to teach all learners how to read for meaning (Phatudi et al., 2014). In other words, preservice teachers should be encouraged to critically engage and investigate the advantages and disadvantages of various teaching reading strategies, theories and instructional resources within a multilingual setting. So, teacher education programs should portray the facts, pose questions and relate content knowledge to pedagogical knowledge (Goodman et al., 1991). According to the *Minimum Requirements of Teacher Education Qualifications* (Department of Higher Education and Training (South Africa), 2015), teacher education programs must strike a carefully considered balance between different types of learning, such as disciplinary, pedagogical, practical, fundamental and situational learning. Shulman and Shulman (Shulman & Shulman, 2004) list the following elements for effective teacher education programs: PCK, disciplinary and interdisciplinary knowledge; curriculum understanding; classroom management, organization and assessment; knowledge of the school and the larger community; achieving a sense of community in the classroom; and understanding learners intellectually, socially, culturally and personally in a developmental perspective. Hence, teacher education should provide preservice teachers with a mixture of specialized content knowledge and pedagogical knowledge (Department of Higher Education and Training (South Africa), 2015), which explains the focus on PCK in this study. Quality teacher education that emphasizes the development of PCK can help bridge the gap between theory and practice (West & Meier, 2016), as PCK highlights the practical application of theoretical knowledge.

3. Preservice teachers' pedagogical content knowledge

The construct of PCK is emphasized in education as it provides insight into teacher knowledge and teaching practice. This construct is well known within the technological, pedagogical and content knowledge model of Mishra and Koehler (Mishra & Koehler, 2006), although the construct PCK was already coined by Shulman in 1986. In the late 1900s, American psychologist Shulman was beginning to understand what he referred to as the complexities of teachers' "transmission of content knowledge" (Shulman, 1986a). He wanted to further understand the domains and categories of content knowledge in the minds of teachers. Content knowledge refers to the amount and organization of knowledge and the various ways content knowledge exists and can be represented (i.e., Bloom's taxonomy) (Shulman, 1986a). He furthermore suggested that content knowledge be divided into three categories (a) subject matter content knowledge, (b) pedagogical content knowledge, and (c) curricular knowledge. Shulman (Shulman, 1986a) therefore originally regarded PCK as a second kind of content knowledge, which he referred to as knowledge that goes beyond subject matter to the "dimension of subject matter knowledge *for teaching*". He defined PCK

as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" and called it the "wisdom of practice" (Shulman, 1986b). Therefore, PCK can be defined as the transformation of the subject matter (i.e., content) based on teachers' interpretations and ways of representing and adapting their instruction according to learners' needs (Shulman, 1986b). Another key term that is aligned with PCK is "pedagogical reasoning". Langsford (Langsford, 2021) argues that PCK is a powerful knowledge base that preservice teachers and teachers can use to navigate their classroom practices and engage in meaningful pedagogical reasoning. Consequently, PCK can be understood as covering the reasoning and decision making behind teaching, learning, curriculum, assessment and reporting (Mishra & Koehler, 2006).

Since pedagogical reasoning is not easily transferable from one context to another (Langsford, 2021), it could be beneficial to distinguish between two different types of PCK – personal and canonical (Kind, 2017). Personal PCK may be developed or adapted by teachers for use in a specific context (i.e., a multilingual Foundation Phase classroom), based on their context or experiences. Canonical PCK, on the other hand, refers to shared or common practices (i.e., the application of the science of reading) that can be implemented by a group of teachers working in a school.

The concept of PCK has gained focus over the years since it has become evident that although teacher qualifications have been associated with better quality education, it is, in fact, teacher knowledge, of both subject matter and pedagogy, that is regarded as the most critical factor in determining learning outcomes in South Africa today (Chisholm, 2019). Van der Berg et al. (van der Berg et al., 2016) argue that teachers cannot teach effectively what they do not know themselves. Without improved PCK, learning outcomes will not improve, as it places "an absolute cap on the attainment levels" of learners (Taylor et al., 2014b). Low levels of PCK among teachers can result in teachers using inadequate reading pedagogies (Taylor, 2014).

Some attribute teachers' PCK deficiency to inadequate training at teacher preparation colleges during the apartheid era and ineffective post-apartheid in-service teacher training (van der Berg et al., 2016). Furthermore, arguments are made that blame post-apartheid teacher education at universities for only instilling abstract theory and not equipping preservice teachers with the necessary PCK for quality teaching (Chisholm, 2019). As such, there is an ongoing debate about who is responsible for the quality of teacher education and training in South Africa, as well as whether it should occur at practice-based colleges, rather than at universities that have been criticized for being mostly theory-oriented.

As the debate continues, there is still insufficient research on preservice teachers' PCK (Pretorius & Klapwijk, 2016). Kind and Chan (Kind & Chan, 2019) argue that if the unrealized potential of PCK research is addressed, it could contribute extensively to teacher education policy and practice. For research on PCK to achieve its potential, it should indicate the how, what and why with regard to the type of knowledge and skills teachers need to develop (Kind & Chan, 2019). Therefore, a better understanding of how PCK can be developed is needed to recognize what is required of teacher education and training. To understand how PCK of teaching reading within a multilingual, Foundation Phase context can be developed, two frameworks – Bloom's taxonomy and authentic learning – were utilized.

4. Theoretical framework

This study was guided by Bloom's (Bloom, 1956) taxonomy and authentic learning principles to develop preservice teachers' PCK with regard to the teaching of reading in the early years.

4.1. Bloom's taxonomy

Bloom's taxonomy guided this study as it has successfully facilitated discussions regarding effective teaching and teacher education for over 50 years (Athanassiou, McNett, & Harvey, 2003; Forehand and Orey, 2005). Bloom's taxonomy is a hierarchical six-level classification system that uses observed behavior to infer the level of cognitive achievement. The multi-tiered taxonomy moves from simple to more complex behavior and requirements (Forehand and Orey, 2005). The levels of the original taxonomy included the following categories: knowledge, comprehension, application, analysis, synthesis and evaluation, each with its own subcategories, except for application (Bloom, 1956; Krathwohl, 2002). However, in the revised taxonomy of Anderson and Krathwohl (Anderson & Krathwohl, 2001), synthesis changed places with evaluation and was named 'create'. The revision was done to allow for more teacher usage and more overlap and to relax the hierarchical process (Krathwohl, 2002).

Bloom's taxonomy has received considerable recognition as an assessment framework, as it is often used for drafting learning outcomes, curriculum assessment and analysis, instruction evaluation and test construction (Athanassiou et al., 2003; Stanny, 2016). However, Bloom's taxonomy has evolved from an assessment framework to a learning and scaffolding tool (Athanassiou et al., 2003; Hogan & Pressley, 1997). It can also be described as a metacognitive and student-centered framework, since it helps preservice teachers gain increased awareness and control of their cognitive development (Athanassiou et al., 2003).

Objections are made to the hierarchical design of Bloom's taxonomy due to its focus on progressive development and the validation of the taxonomy. The levels are not always distinct, which makes the taxonomy behavioral rather than theoretical (Athanassiou et al., 2003; Stanny, 2016). While these critiques are acknowledged, this study argues that Bloom's taxonomy is valuable as a heuristic device and a scaffolding tool within teacher education programs. Bloom's taxonomy can be used within teacher education to discover and develop more effective approaches, tools or strategies to reinforce aspects of higher-order thinking, PCK and authentic learning.

For instance, in this study, preservice teachers were expected to address the reading problem in multilingual South African schools by designing their own reading programs that are aligned with the science of reading. The 'design' objective of the project forms part of Bloom's taxonomy's 'create' category. The 'create' category is associated with various higher-order thinking skills, such as arrange, compose, construct, develop, design, explain, evaluate, generate, improve, integrate, invent, make, manage, modify, organize, plan, produce, propose and specify (Krathwohl, 2002; Stanny, 2016). The above-listed skills are also aligned with the criteria of authentic learning requirements. Therefore, Bloom's taxonomy and authentic learning collaboratively served as a lens for this study.

4.2. Authentic learning

In teacher education, the ultimate goal is to prepare preservice teachers for real-world practice, which requires authentic learning within teacher training programs. Unfortunately, the incorporation of authentic learning opportunities within teacher training is often sacrificed due to reduced funding, large classes, high workload, assessment requirements and administrative constraints. More manageable and expedient learning opportunities are used that can readily be incorporated into any module or course within the teacher training program (Herrington, 2006; Herrington, Reeves, & Oliver, 2010; Lombardi, 2007). The concept of authentic learning is a philosophy and framework for curriculum design that had been developed out of a body of research that sought to understand learning in workplace apprenticeships and situated learning, also known as situated cognition (Brown, Collins, & Duguid, 1989; Roach, Emanuela, & Mitchell, 2018b). This concept has had implications across various educational sectors that place learning in an active, student-centered and more authentic environment. Authentic learning can broadly be defined as real-world tasks that are

inherently and intentionally multidisciplinary (Lombardi, 2007). However, the concept of authentic learning is difficult to define because there is no singular criterion for authentic learning; instead, it is a collection of characteristics (Johnson, 2012). The following criteria have been listed for authentic learning to occur: real-world relevance; contextualized or situated learning; problem solving from a theoretical or practical perspective; considering multiple interpretations; complex task; requires significant investment of time; uses a variety of resources; collaboration within module and real world; opportunities for reflection; freedom of choice; and addresses an interdisciplinary perspective that leads beyond domain-specific outcomes (Herrington, 2006; Lombardi, 2007; Roach et al., 2018b). Thus, authentic learning refers to a wide variety of educational and instructional techniques that are focused on connecting what preservice teachers are taught about real-world issues, problems and applications (Dolapcioglu & Doğanay, 2020). Problem solving is a key criterion for authenticity in teacher training (Putnam & Borko, 2000). Preservice teachers can, therefore, experience authentic learning through problem solving (Putnam & Borko, 2000) and complex tasks that they have investigated over a sustained period, which requires a significant investment of time and intellectual resources (Johnson, 2012). For authentic learning to occur, preservice teachers need to make connections to existing knowledge and deeply explore new knowledge in context (Lombardi, 2007). Wang, Dyehouse, Weber and Strobel (Wang, Dyehouse, Weber, & Strobel, 2012) analyzed conceptualizations of authentic learning in a systematic literature review. From their findings, they propose four criteria for authenticity: context authenticity, where the content resembles real-world content; task authenticity, where the activities resemble the real world; impact authenticity, where student outputs are used in the real world, for example, schools or the community; and personal or value authenticity, where projects or activities should be personal and students' own questions get answered or the project itself satisfies personal needs.

In line with the objectives of this study, authentic tasks must culminate in the creation of a whole product, rather than an exercise or sub-step in preparation for something else. Authentic tasks are learning opportunities to create polished products, valuable in their own right (Herrington, 2006). For authentic learning to occur, preservice teachers must be engaged in an inventive and realistic task that provides opportunities for complex collaborative activities (Herrington et al., 2010). Therefore, during this study, preservice teachers were challenged to solve a real-world problem (i.e., Foundation Phase learners' reading skills) within an authentic context (i.e., multilingual schools in South Africa) by being inventive, realistic, creative, resourceful and designing a whole product over a sustained period of 16 weeks. Applying the abovementioned authentic learning principles within this timeframe was challenging. It required careful planning and conceptualization within the existing program to ensure its alignment with the curriculum objectives. Another challenge was the amount of time needed for the design of the whole product.

5. The contextualization of the study

In the past two decades, research has suggested that in-service training has had a limited impact on addressing the low reading proficiency of South African learners (Phatudi et al., 2014). Therefore, equipping preservice teachers with PCK could help break the cycle of poor reading achievement. Addressing preservice teachers' PCK by utilizing Bloom's taxonomy and authentic learning principles in this study can be viewed as an effort to bridge the gap between theoretical knowledge and practical application (Brown et al., 1989).

This study aimed to challenge preservice teachers to apply higher-order thinking skills, as guided by Bloom's taxonomy, by designing their own reading programs – an authentic, real-world product within the multilingual South African context. The designed reading programs were then reviewed by an expert in the field (e.g., a teacher or reading practice expert) as part of the authentic learning experience. The expert reviewers had to provide structured feedback by evaluating and reporting on different components of the preservice teachers' reading programs. Upon receiving the feedback, the preservice teachers engaged in reflection and made the necessary revisions to their reading programs.

Over 16 weeks, Bloom's taxonomy was used as a scaffolding tool to expose the preservice teachers to different components of PCK about teaching reading. For example, during the first four weeks of the program, the preservice teachers were introduced to language learning theories and the fundamentals of reading (i.e., science of reading). Thereafter, language and reading development was contextualized within the multilingual South African context by using authentic case studies and problem-solving activities. From week 7–11, the program focused on the different components of reading (i.e., phonological awareness, phonics, word recognition, vocabulary, fluency and comprehension). The preservice teachers had to identify, describe, analyze, compare and evaluate (i.e., different levels of Bloom's taxonomy) various existing reading programs, such as bottom-up, top-down and balanced reading approaches and programs. Thereafter, they explored the interconnectedness of reading and writing. Throughout the 16 weeks, they had to integrate the content knowledge and PC they had gained by making informed and evidence-based decisions on approaches they wanted to incorporate into their reading programs. In essence, their acquired knowledge was translated into developing their own authentic reading programs. These programs differ significantly from the traditional teacher education programs used in the past, where preservice teachers studied the different components of teaching reading and then demonstrated their understanding through summative examinations.

Participants were selected through non-probability purposive sampling based on defining characteristics and specific criteria, such as being second-year students from a specific university in South Africa who had successfully completed the previous language education modules in their first year of study. They were enrolled for the second-year literacy practices module, which required the design of their own reading programs. The sampling criteria ensured the collection of rich, in-depth data on the participants' experiences in developing PCK. The participants were all bilingual, identified as female and aged 19–21 years. All the participants reported exposure to multilingual schools where learners were taught how to read in a language that was not their mother tongue.

6. Methodology

Using an interpretivist paradigm and exploratory qualitative research design, data were collected from 20 s-year preservice teachers (N = 28, 71% response rate) who voluntarily participated in the study. The purposefully chosen participants were all enrolled for an undergraduate, second-year language education module as part of a four-year Bachelor of Education degree at a South African university. The interpretivist lens was ideal for this study owing to the active involvement of the participants (Magam, 2018). The participants' perspectives, experiences and opinions played an essential role in understanding how the application of Bloom's taxonomy and authentic learning principles can develop or accelerate the development of preservice teachers' PCK. In essence, I utilized an interpretivist paradigm with the hope of contributing to a theoretical and practical understanding of the development of preservice teachers' PCK (Sebastian, 2019). Furthermore, the qualitative exploratory research design aimed to describe, explain and explore the development of preservice teachers' PCK by using multiple sources of data collection and to avoid narrowness in the field of teacher education (Nieuwenhuis et al., 2019; Trochim, Donnelly, & Arora, 2016).

I collected data from multiple sources, such as a document review (participants' designed reading programs and expert review reports) and a qualitative, open-ended reflection questionnaire that consisted of mostly open-ended questions about their experiences in developing PCK, to gather rich, in-depth, descriptive data that allowed for triangulation (Maree et al., 2019). The open-ended questionnaire was

informed by existing questionnaires about PCK, such as that of Kratz and Schaal (Kratz & Schaal, 2015). However, owing to the qualitative nature of the study, most items were adapted and phrased open-ended to allow for elaboration and interpretation.

The data were gathered to explore the possibilities, benefits and limitations of designing reading programs with the aim of accelerating the development of preservice teachers' PCK. Data analysis was done inductively by using open coding and thematic analysis with Atlas.ti, a qualitative software program. Thematic analysis facilitates the development of themes across datasets, which gives a systematic overview of the scope of the data, allowing for an exploration of their meaning within their particular context (Ritchie, Lewis, McNaughton, & Ormston, 2014).

7. Results and discussion

From the data gathered, two main themes emerged that holistically answered the three research questions. The two themes are interpretations of the possible interaction between different theoretical constructs, such as authentic learning, Bloom's taxonomy and PCK. Owing to interpretivism as a paradigm and the inductive analysis method used, signifiers of these three theoretical constructs were identified in the participants' responses, capturing the preservice teachers' experiences in designing their own reading programs.

7.1. Theme 1: leveraging authentic learning principles can promote PCK development in teacher education

Theme 1 and its subthemes helped answer the following research question:

What are the benefits of designing reading programs at the undergraduate level as part of the Bachelor of Education curriculum?

This theme and subthemes that emerged from the thematic analysis revealed that leveraging authentic learning principles within a language education module (i.e., teaching reading) helped preservice teachers to develop their PCK about reading. From the preservice teachers' reflections could be inferred that designing their own reading programs (a practice-based product) benefited them owing to the authentic nature and focus on the real-life practice of this exercise. They listed the following benefits in their open-ended reflection questionnaire, which are aligned with authentic learning principles and are, therefore, regarded as subthemes. These subthemes show how authentic learning can contribute to the development of PCK:

- Promotes a deeper understanding of the content knowledge being taught
- Integration of different types of knowledge
- Develops preservice teachers' critical thinking skills
- Activates preservice teachers' creative thinking
- Encourages metacognitive awareness about own teaching beliefs
- Creates mindfulness about theory in practice
- Develops preservice teachers' knowledge of the implementation of the curriculum and policies
- Promotes self-regulated learning

Table 1 below provides a list of benefits and excerpts as evidence.

The above excerpts show that the preservice teachers enjoyed designing their own reading programs and found it beneficial for reasons associated with authentic learning. One preservice-teacher stated that "for the first time an assignment was truly worthwhile".

The design component that the preservice teachers found beneficial is grounded in the 'create' outcome of Bloom's taxonomy (Krathwohl, 2002). In the next theme that emerged from the data, I elaborate on how Bloom's taxonomy served as a theoretical framework and a possible metacognitive learning framework.

Table 1
Benefits of authentic learning and practice-based opportunities.

Subthemes	Examples or evidence from the raw data
Promotes a deeper understanding of the content knowledge being taught	"It contributed to my learning with regards to my creativity and providing me with an in-depth understanding of what is necessary for a lesson." "The reading program truly provided me with more knowledge and understanding." "I gained knowledge about the whole module by revising everything taught in the module while designing my programme." "I learned so many new things that my mind was 'baffled', things that you would never think about and all of a sudden we are learning about it while designing our programmes. The more I think back about how some teachers taught when I was at school, it is like building a puzzle, I now understand the approaches such as the bottom-up and top-down approach." "I won't be able to list all the knowledge and skills that I have gained by designing a reading programme. It was so enriching and it changed my views and perspectives about literacy education. It made me excited about teaching language."
Integration of different types of knowledge	"I tried my best to integrate different types of knowledge." "I integrated different types of knowledge when designing my programme." "I used different sources and a wide variety of topics and used different information that I gained during the semester. I revised all the work so that I could better understand how to combine it." "It required of me to merge the different knowledge and skills I have gained".
Develops preservice teachers' critical thinking skills	"You had to keep all the different aspects in mind throughout designing the programme." "The program had me thinking critically about how to design a programme, which approach and methods to use, how do I apply the theory, how does it align with CAPS,[a] how do I want the programme to look and feel and how do I want to get the information across." "The reading programme definitely challenged me critically and creatively, because the lesson had to be creative for children to make it fun and enjoyable for them to learn and to motivate them to learn. The lesson also had to be designed critically to ensure that they develop correctly and to ensure that they develop and learn effectively." "My critical thinking was challenged on a whole new level. It was difficult to plan and decide the order in terms of the programmes to ensure that there is a logical flow and that one lesson builds on a previous one and so that learners learn."
Activates preservice teachers' creative thinking	"We had so much room in the portfolio to give our inputs and to use our creativity in terms of how we want to design the programme and which resources we wanted to use and make." "Any teacher must be able to be creative, especially in the Foundation Phase.

(*continued on next page*)

Table 1 (*continued*)

Subthemes	Examples or evidence from the raw data
	Lesson must be presented creatively in order for children to not get bored and distracted with the teacher and the lesson. And when more creativity is put into lessons, the easier it gets to be creative. It is like a chain reaction. It is the same with the programme's lessons." "I thought hard to be creative and to have creative thoughts. The moment that I was creative, I got so many ideas to design my programme and how to make it interesting." "My creativity was challenged by the way in which I had to make the programme look pretty, how do I make it look in a way that makes people want to read it and buy it. Which pictures must I use? Is my Bitmoji professionally dressed and does it come across as professional, but friendly? Does it show who I am as a teacher/future teacher?"
Encourages metacognitive awareness about own teaching beliefs	"I gained knowledge about my own existing knowledge of teaching reading and I gained knowledge on the best practice with designing a reading programme." "I have gained an understanding about what I am learning, the why and how – It is not just memorising." "… it helped me to learn about myself in the process as well. For example, I always thought that I was a bottom-up person myself, but as I developed the programme I realised that I was more focused on top-down approaches. I tried to figure out why and realised that I feel like it works better for me personally and as a future teacher."
Creates mindfulness about theory in practice	"To use and apply a variety of teories in your own way with resources and worksheets and activities was a challenge every now and then. It is definitely not easy to design 20 lessons for a programme. "I expanded my knowledge about reading and writing and how important the research behind all of it is". "The term 'evidence-based' now makes more sense to me – it is linked to theories in practice."
Develops preservice teachers' knowledge of the implementation of the curriculum and policies	"I learned a lot about the CAPS document and I think I now understand it better as well as how to align and incorporate it into my classroom one day." "It was a challenge for me to use CAPS to align each of my lessons, but it helped me a lot to do it." "The programme had me thinking critically about how to design a programme that aligns with what CAPS is saying."
Promotes self-regulated learning	" It was so much fun for me to design my own reading programme. I had to do a lot of research on my own to ensure that my reading programme will meet its outcomes and objectives." "I learnt a lot through this process, for example, that a person must do a lot of research if you want to develop your own programme. The research I did contributes tremendously to my own learning because everything I learnt in the module I could now apply." "… as a person did more research, the easier it got because you understood better about the different topics, approaches or strategies." "It expanded my knowledge by having to read articles and theory information online and watching videos where teachers are physically sitting and working with learners." "I went to the library for hours and looked at different children's literature that is available and to my amazement, I found so many different types of books that made it more difficult for me to decide on a reading series for my programme. "It helped me a lot; it forced me to do more research and I will definitely want to use my own programme in practice one day." "I honestly think that designing the programme taught me so much more than what I would have learnt by writing an exam because I had to do my own research and do extra reading."

[a] CAPS abbreviates Curriculum and Assessment Policy Statement. It is the South African curriculum, developed by the DBE, that is used in South African schools.

7.2. Theme 2: Bloom's taxonomy as a possible metacognitive learning framework

The findings that emerged in Theme 2 helped to answer the first research question:

How can the design of reading programs better prepare preservice teachers for the teaching of reading?

From the benefits listed in Theme 1, it is evident that there were various benefits to having preservice teachers design their own reading programs. The findings further indicate that designing their own reading programs also helped develop their metacognitive awareness about their teaching experiences and beliefs. The preservice teachers' statements such as "*learn about myself*", gain "*knowledge about my own existing knowledge*" and understand "*my own thinking about teaching*" are aligned with the argument (Athanassiou et al., 2003; Hogan & Pressley, 1997) that Bloom's taxonomy should be used as a learning and scaffolding tool, as it helps increase metacognitive awareness and control of one's own cognitive development. Therefore, the data from this study resonate with the literature that describes Bloom's taxonomy as a metacognitive framework instead of a hierarchical assessment framework. It is important to note that developing and experiencing metacognitive awareness are also aligned with the fourth criterion for authenticity – value authenticity – provided by Wang et al. (Wang et al., 2012) as the preservice teachers were able to answer their own questions regarding the teaching of reading. Moreover, the reading programs provided them with a valuable tool for future use.

It is necessary to understand how the design of reading programs helped these preservice teachers develop their metacognitive awareness. From the data, it is clear that looking at the challenges they experienced in designing their reading programs was useful. The challenges that emerged from the open-ended reflection questionnaires were time investment and the practical application of theory. The preservice teachers explained that the design of reading programs "*took a lot of time*". Evidence for this is found in the following excerpts:

> I spent very long hours on designing my programme and that made me realise what hard work is involved in completing a degree in teaching, but it is what I enjoy doing and all the theory that we learn is important.

> … a crazy amount of time to plan and make each lesson in my programme creative and exciting.
>
> It was a challenge to manage my time to ensure that all of the work on my programme is properly done and thorough. I also had to make sure that I have enough time to get to everything so that I don't rush the process.

Even though the preservice teachers viewed time investment and time management as a challenge, it is a requirement for authentic learning to occur (Herrington, 2006; Johnson, 2012; Lombardi, 2007; Roach et al., 2018b). Time investment allows them to deepen their learning, make connections to existing knowledge and deeply explore new knowledge in context (Lombardi, 2007). It is, therefore, necessary to challenge preservice teachers to spend enough time on a project to ensure that authentic learning occurs.

The preservice teachers also explained that they were challenged to apply the theoretical knowledge in a "*practical way*", which is aligned with the second criterion for authentic learning – task authenticity (Wang et al., 2012). Task authenticity was achieved by having them participate in a practice-based task that can be used in the real world, that is, their future classrooms. Evidence for this can be seen in the following excerpts:

> From [sic] the challenges that I experienced in designing the programme, it was the most challenging to apply the theory that we have learnt and the knowledge that is in my brain. It is not so easy to put it on paper.
>
> I especially experienced it during the application of theory which is abstract, now I had to present it in a concrete manner for a learner.
>
> A person had to be able to apply the theoretical knowledge that we learnt as well as give it your own twist – that was challenging.
>
> My biggest challenge was with the teaching strategies and approaches. It was difficult to decide [on] one and then to apply it.

Furthermore, they explained that the challenge to apply theory in practice helped them to gain better PCK, which relates to the findings of Theme 1. Here are a few excerpts as evidence:

> I now know how to teach learners in the right way [so] as to ensure effective learning in the right manner.
>
> I also know what to do when a learner is struggling with certain skills and how to help them.
>
> It definitely prepared me for teaching in a school because I now know a lot more of what is needed for each specific age group and I also learned how to design a lesson, a lesson that has all the necessary elements that the learners need for effective learning.
>
> I learnt that there are various ways one can teach reading and writing skills and that numerous factors can influence that decision in practice.

The preservice teachers' struggle to practically apply theoretical knowledge was evident from not only the open-ended questionnaires but also the document analysis of the reading programs and the expert review reports. In the first section of the reading programs, they had to introduce and provide background information about their reading programs. Most of them excelled in this section. In the second section, they had to design lessons for their programs. In these lessons, the students' background information was not always aligned with the strategies they applied. For example, one preservice teacher wrote that her program was based on a bottom-up approach focusing on phonics and phonemic awareness, while her lessons actually focused on word recognition and reading fluency, which is a top-down approach. Many of the preservice teachers who said that their reading programs were based on a bottom-up approach actually used reading a series of books based on a top-down approach and focused on vocabulary expansion instead of phonics development. Next is an example of a preservice teacher who said that her program was based on a bottom-up, phonics-based approach, but instead, had lessons focused on vocabulary and grammar.

Next is another example, where a preservice teacher requested learners to read words for 20 min, which is an activity that should last no more than 3 min, depending on the learners' reading ability.

Another example of misalignment between theory and application entails the resources the preservice teachers designed to accompany their lessons; they did not always know how to design effective, age-appropriate or outcome-driven resources. Even though they were taught about the requirements for designing resources, they did not always meet those requirements. Below are examples of worksheets with the mistaken goal of developing reading comprehension (Figs. 1, 2 and 3).

The document analysis of the preservice teachers' designed reading programs and the expert review reports showed that the preservice teachers struggled with applying theory. Thus, all the data collected showed that they struggled with task authenticity, requiring them to apply theoretical knowledge practically.

8. Conclusion

The 'design' component of Bloom's taxonomy and authentic learning principles require preservice teachers to spend time on the practical application of theory. By having a group of preservice teachers participate in a higher-order thinking project that requires them to create (as described by Bloom's taxonomy), they were challenged to think critically and creatively about the teaching of reading. The design of reading programs – an authentic, real-life product – engaged them on a deeper and more meaningful level with the content they were exposed to in the module. Furthermore, creating an authentic product, which is valuable in its own right, is aligned with Herrington's (Herrington, 2006) definition and requirements of authentic learning. The design of a reading program is inventive, promotes engagement in realistic tasks and has real-world relevance owing to its authentic nature and objective to have preservice teachers make connections to their existing knowledge and explore new knowledge in context (Lombardi, 2007). The reading program can also serve as a resource in the future.

Furthermore, the design of reading programs met the four criteria for authentic learning (Wang et al., 2012). Context, task and impact authenticity was achieved by having the preservice teachers design a product meant for use in the real world (i.e., the multilingual classroom). Personal or value authenticity was achieved owing to benefits such as the preservice teachers developing a deeper understanding of the content knowledge, critical and creative thinking, metacognitive awareness and mindfulness about theory in practice. Challenging preservice teachers on a higher cognitive level can help them develop metacognitive awareness about their own experiences with teaching and their own teaching beliefs. Another benefit of designing reading programs is learning about the implementation of the curriculum and the alignment of policies, as well as the promotion of self-regulated learning, as they are encouraged to do their own research.

The findings also revealed that collaboration between Bloom's taxonomy and authentic learning principles allows for developing PCK. As such, PCK is developed not only because of the authentic nature of the task but also because the preservice teachers are required to engage with theory through practical application.

To conclude, based on the findings of the study, the recommendation is made that Bloom's taxonomy should be viewed as a metacognitive learning framework, rather than a hierarchical assessment framework (Athanassiou et al., 2003; Hogan & Pressley, 1997; Stanny, 2016), as it results in deeper and more meaningful learning that helps prepare preservice teachers for real-life practice. In addition, to enhance preservice teachers' PCK within teacher education, I recommend the collaboration of Bloom's taxonomy and authentic learning principles when framing or conceptualizing undergraduate teacher education

Date:	15 June 2021
Activity:	Complete the words activity
Length:	40 minutes
Resources:	Worksheet
Skills addressed:	Phonemic awareness, phonics

1. **Objectives and outcomes:**

- Provided with the definitions and basic information about prefixes and suffixes, the students will have the ability to identify and define these concepts effectively.
- Given the different types of prefixes (pr, st etc.) the class should be able to list words that contain such prefixes.
- Given the different types of suffixes (ant, aw, etc.) the class should be able to list words that contain such suffixes.

Fig. 1. Example 1 – misalignment between theory and application.

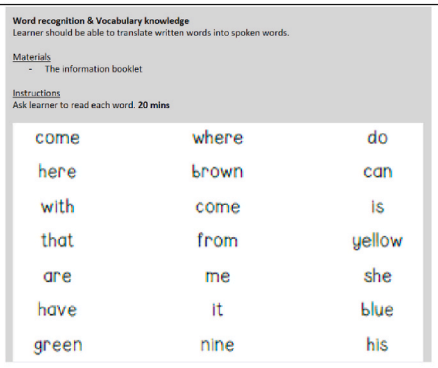

Fig. 2. Example 2 – misalignment between theory and application.

Figure 3. Example 3 – misalignment between theory and application.

projects. Lastly, I also recommend that more research be conducted to explore how Bloom's taxonomy as a metacognitive framework can be used to better prepare preservice teachers for practice.

9. Limitations

This study has several limitations. First, data were collected from a small sample (20 s-year education students) at one South African university. Although all teacher education curricula in South Africa are aligned with the *Minimum Requirements of Teacher Education Qualifications*, it is still not adequately representative of the teacher education programs of all universities and higher education institutions in South Africa. Furthermore, the researcher of the study acted as a facilitator in the program, which could have influenced the objectivity of the findings reported. However, she worked with a research team who collected the data by using online, anonymous platforms, which helped safeguard against biases. Another limitation is the lack of focus on the different types of PCK regarding teaching reading. Further studies are necessary to unpack the different types of PCK involved.

CRediT authorship contribution statement

Joyce West: Conceptualization, Formal analysis, Methodology, Data curation, Investigation, Project administration, Visualization, Writing -

original draft, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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