A Sense-Making and the Use of Teaching Materials in Resource-Constrained Classrooms

Maxwell Tsoka

University of Venda, Africa

*Corresponding Author: maxwell.tsoka@univen.ac.za

Abstract:

> This study examines how prospective teachers understand and use teaching and learning materials in the context of under-resourced schools. The goal is to uncover how the sense-making process influences pedagogical decisions when teaching. The research used a phenomenological approach with classroom observation and in-depth interviews with one prospective teacher who taught the topic of electrical circuits in grade 9. Thematic analysis is used to identify patterns of use of teaching materials and the way prospective teachers interpret their functions. The results showed that the selection of teaching materials was driven by personal experience and peer recommendations, rather than mature pedagogical considerations. The implementation of the material in the form of videos takes place passively without activities that encourage student involvement. Prospective teachers are not able to connect teaching tools with learning objectives so that the potential of the material is not utilized optimally. The discussion highlighted that limited sense-making has an impact on the quality of learning and hinders the development of professional competencies. The findings of the study suggest the need for professional learning communities to strengthen the pedagogical reflection and understanding of prospective teachers. This study shows that structured support can improve the ability to use teaching materials effectively in the context of limitations.

Key Words: *Sense-Making; Teaching and Learning Materials; Pre-Service Teachers; Pedagogical Practice; Resource-Constrained Schools; Learner Engagement*

INTRODUCTION

Persistent inequalities in access to quality learning resources continue to undermine educational equity in many low- and middle-income countries (Akar, 2024; Ilie et al., 2021; Reinders et al., 2021). Recent global estimates suggest that learning poverty in these systems has risen to around 70 percent, with as many as 86 percent of children in Sub-Saharan Africa unable to read and understand a simple text by age ten, despite expanded access to schooling (UNICEF, 2022). These macro-level disparities are mirrored within national systems such as South Africa, where schools serving low-income communities typically operate with chronic shortages of teaching and learning materials (TLMs), overcrowded classrooms, and limited laboratory or digital infrastructure. In science education, such resource constraints are particularly consequential because the learning of

abstract concepts, including electric circuits, often depends on visual and hands-on representations. Within this landscape, pre-service teachers' (PSTs) sense-making about the selection and pedagogical use of TLMs becomes a critical yet underexamined dimension of their professional formation.

Recent scholarship has begun to document how teachers in resource-constrained settings navigate and repurpose available materials. Chirinda et al. (2021), shows that mathematics teachers in South African schools with limited resources develop varied "teacher–textbook relationships," sometimes using the textbook as a script, at other times adapting or resisting it in light of learners' needs and contextual constraints.Tandfonline A systematic review by Carrete-Marín & Domingo-Peñafiel (2022) indicates that in rural and multigrade schools, teachers frequently rely on textbooks and locally produced materials, yet face persistent challenges in aligning these resources with inclusive and active learning goals. Roche et al. (2023) demonstrate how structural resource constraints in community learning centres depress learners' mathematics attainment and constrain teachers' instructional choices. Masalimova et al. (2024) finds that PSTs' preparedness to teach science is closely tied to their pedagogical content knowledge and self-efficacy, and that programmes often remain insufficiently responsive to socio-economic realities in which many graduates will teach. Together, these studies foreground the centrality of TLMs, but they largely conceptualise teachers as established practitioners rather than novices still negotiating their professional identities.

Against this backdrop, there remains a notable gap in understanding how PSTs themselves construct meaning around TLM use when they first encounter the realities of under-resourced schools. Existing research has tended to treat materials either as systemic variables or as artefacts within teachers' established repertoires, rather than as objects of ongoing sense-making for novices who are still learning to teach. Prior work in rural and low-resource contexts has rarely traced how a single PST interprets, selects, and enacts TLMs in real-time classroom practice, nor how these processes are shaped by the intersection of prior disciplinary training, teacher-education experiences, and the socio-economic status of the school. Moreover, while reviews highlight the need for context-sensitive criteria for selecting and adapting materials (Belver et al., 2023; Fontaine et al., 2025), there is limited phenomenological research that captures the lived experience of navigating these criteria within a resource-constrained science classroom. This study addresses that gap by focusing on the fine-grained sense-making of a PST teaching natural sciences in a quintile-three school.

The study therefore aims to explore in depth how a pre-service science teacher interprets and uses TLMs in a Grade 9 lesson on electric circuits in a South African school with limited material resources. Specifically, it seeks to characterise the participant's reasoning when selecting particular materials, the ways in which these materials are mobilised during instruction, and how the teacher interprets learners' engagement and understanding in relation to those

choices. By examining a PST who enters teacher education with a background in electrical engineering and subsequently undertakes a postgraduate certificate in education, the study also interrogates how prior disciplinary expertise interacts with the realities of a low-resource classroom. In doing so, the research extends existing work on TLMs and teacher knowledge by foregrounding the subjective, interpretive dimensions of resource use during the formative stages of a teaching career, offering insights that are highly relevant for the design of responsive teacher-education curricula.

The central analytical focus of this qualitative study is the PST's sense-making process regarding TLMs as reconstructed through classroom observation and in-depth interviewing. Rather than treating materials as neutral tools, the study approaches them as mediating artefacts whose pedagogical affordances are continuously interpreted, negotiated, and sometimes constrained by the teacher's beliefs, experiences, and working conditions. A descriptive phenomenological orientation is adopted to capture the lived experience of planning and enacting a science lesson in a context where resources are scarce but curricular expectations remain high. Through this lens, the study argues that PSTs' interpretations of TLMs are pivotal for understanding how resource constraints are reproduced or disrupted in everyday classroom practice. The subsequent methods section elaborates the phenomenological design, data collection procedures, and thematic analysis through which these sense-making processes are examined.

RESEARCH METHOD

This study uses a qualitative approach with a descriptive phenomenological design to explore in depth the lived experience of a pre-service teacher in using teaching and learning materials in science learning grade 9 in quintile three schools. Phenomenology was chosen because it is appropriate to understand how individuals give meaning to their pedagogical experiences, especially the sense-making process when selecting and applying TLMs in the context of limited resources. Phenomenology seeks to capture the essence of the experience as experienced by the participants, not just the behavior or context (Aguas, 2022; Alhazmi & Kaufmann, 2022; Urcia, 2021). The researcher's position is reflective and subordinate, focusing on a pure description of the participant's experience without committing to excessive theoretical interpretation. The research setting, i.e. quintile three rural schools, provides an authentic context that reinforces the research objectives to understand how personal experiences, academic backgrounds, and interactions with the classroom environment interpret the use of TLMs.

Data collection was carried out through non-participating observation and in-depth interviews (Ferdiana et al., 2024; Kannaujiya et al., 2025), two techniques commonly used in phenomenology to capture subjective experiences and participants' conscious processes. Unstructured observations allow researchers

to flexibly record how Happy interacts with TLMs, how student responses emerge, and how teaching practices take place without initial category constraints. In-depth interviews are used to explore meaning, beliefs, and reflective considerations related to the selection and use of TLMs. Interview questions are directed at what he experienced, why he chose a particular material, and how he interprets the practice as a prospective science teacher. The research was conducted at the participant's home school during the teaching practice period.

Data analysis follows thematic analysis because this technique allows the researcher to extract the essence of the experience according to the purpose of descriptive phenomenology (Finlay, 2021; Lochmiller, 2021; Shoufan, 2023). The process starts with the repeated reading of the data, the open-ended encoding of experiential expressions, the drafting of a theme that represents the core aspects of the sense-making process, and then reviewing and refining the theme to fit the phenomenological description. This approach provides an in-depth understanding of how to construct the meaning of using TLMs in the context of under-resourced classrooms and how the experience shapes their professional development as a prospective teacher.

RESULT AND DISCUSSION
Result

In this section, the findings from the data analysis are presented. The findings are organised into themes that reflect the sense-making process, namely: motivating factors for TLM selection, implementation of TLMs, and adaptations or modifications made in practice.

Motivating Factors for Selecting the TLMs

This theme explores the antecedents influencing the pre-service teachers' (PSTs') decisions in choosing specific teaching and learning materials. Motivating factors refer to the initial triggers or inspirations that led to their selection of particular tools or resources. To provide an overview of these influences, Table 1 summarises the key motivating factors identified in the analysis.

Table 1. Motivating Factors for Selecting TLMs

Motivation Domain	Description of Findings
Pedagogical	Videos help make the concept of flow concrete. Simulations make it easier for students to understand the difference in currents in series and parallel circuits.
Epistemic	The video helps students understand concepts through visualization of electron movement and current division. The enthusiasm of students is a sign of understanding.

Affective	Happy wants to create a relaxed and interesting classroom atmosphere. He mimics the experience of watching in a cinema so that students feel comfortable and involved.

Table 1 shows that Happy's decision to use a video suite was shaped by three layers of motivation. Pedagogically, she relied on video simulations to make abstract concepts like electric current flow more concrete for learners. Epistemically, she believed visualisation would deepen understanding, as shown by students' enthusiastic responses. Affectively, her own rigid schooling experiences motivated her to create a relaxed, cinema-like atmosphere that encouraged comfort and engagement. Together, these factors reveal that her choice of TLMs was driven not only by instructional goals but also by emotional and experiential influences that shaped how she interpreted effective teaching.

For example, Happy opted to use a video suite of a recorded lesson she had downloaded from the internet, instead of the suggested materials in the curriculum document. The choice of using the video instead of the suggested materials demonstrated the influence of episodic power on sense-making. Episodic power captures deliberate efforts of actors to coerce, influence, or manipulate others.

This video was presented via her laptop and connected to an external speaker to ensure audibility. The idea to use this multimedia resource emerged from a conversation with a fellow PST who was also teaching Natural Sciences at the same school. As she explains, "it was not really my idea, it was something that I actually learned from my colleague, which he used for his students… he showed me a couple that he used, and then that one, the one that I pinned, was the one that was relevant to what I was teaching."

Happy shared several reasons for her decision to use the video suite, reflecting a combination of pedagogical, epistemic, and affective considerations. From a pedagogical standpoint, she saw the video suite as a powerful tool for transforming the abstract concept of current flow into accessible and engaging formats for learners with varying levels of understanding. She explained, "I wanted to actually explain the concept of [electric current] flow, because they had to understand how it works... The key part for me was when she (referring to the teacher in the video) explained how current flows in a series circuit and then showed the simulation. The video was mainly for that simulation—so they could visualize what we mean when we say current flows through a single pathway in a series circuit, and how, in parallel circuits, it's actually split across the different components."

She further commented, "I was able to visually demonstrate the concept I was explaining. I showed them how electrons move, how parallel and series circuits function, and this helped them see it from a different perspective."

Epistemically, Happy suggested that the video tool had the potential to support a better understanding of the concept by enabling learners to visualize

abstract concepts. She suggested, "That small portion was very helpful in making them understand the concept better. They were very excited to understand what I was saying. It's like a light bulb clicked. Oh, this is what ma'am was saying when she said that for the parallel circuits, the current is split across the resistors, or for the series circuits, it only has one pathway. So when they saw the electrons move in that video, it actually sparked interest, and it also made them understand what I was trying to teach them."

On an affective level, Happy was deeply inspired by the potential of the dynamic and interactive video suite to transform the classroom environment. She envisioned a shift from the conventional, rigid educational settings of the past to a more contemporary, learner-centred space. Drawing from her own experiences as a learner, she was determined to create a classroom atmosphere that was relaxed, engaging, and emotionally resonant—something akin to the immersive experience of a movie theatre.

For Happy, traditional classrooms had been spaces of constraint and silence, where strict discipline overshadowed curiosity and interaction. Reflecting on her schooling days, she shared, "I saw myself in those students. I didn't like school because school felt like the military, where you were not supposed to talk. You only talked when the teacher spoke to you." These memories shaped her sense-making process, motivating her to foster a more open, inviting learning environment.

She aspired to move away from the seriousness and rigidity of traditional classrooms, replacing that with an atmosphere where learners could feel at ease, actively participate, and enjoy the learning process. "I wanted it not to be as serious as your normal traditional classroom," she explained. "More like a feeling of being in the cinema, watching TV." Through the use of the video suite, Happy hoped to captivate her learners' attention and transform the educational experience into one that felt both enjoyable and meaningful.

Overall, her sense-making was driven by the desire to cultivate an inclusive, conceptually robust, and emotionally engaging learning environment that supported learners without placing undue emotional strain.

Despite the comments made by Happy on her use of video as a teaching tool, she remained aware that her sense-making of the tool was still developing. Demonstrating a reflective and proactive approach to professional growth, she sought guidance from the researcher on how to enhance her practice in preparation for an upcoming teaching assessment. She asked thoughtfully, "Where could I improve if I want to use a video in my upcoming assessment? What would you advise me to avoid or to do differently?" Her questions revealed an awareness of the dynamic and iterative nature of sense-making, acknowledging that the process of interpreting and applying new tools is continually shaped by emerging insights, experiences, and feedback.

By synthesizing Happy's reflections, it becomes possible to identify the specific gap she was grappling with in her teaching practice, which was "to

engage my students more." When prompted to elaborate on what learner engagement meant to her, Happy explained: "I mean having them pay attention to what I was saying, having them ask questions or participate, and not having them wander around."

Her response reflects a predominantly teacher-centred view of engagement, one where learners are expected to direct their attention toward the teacher, listen actively, and respond within the boundaries of teacher-led instruction. In this perspective, Happy positioned herself as the central figure in the learning process, with engagement defined largely in terms of compliance, attentiveness, and orderly behaviour. Missing from this view is an emphasis on learners engaged with disciplinary content through hands-on or inquiry-based activities, where learners were supposed to take a more active and autonomous role in constructing knowledge. In this sense, Happy's understanding of engagement appears to prioritize control and attention over deeper cognitive and collaborative involvement in meaningful learning tasks.

Implementation of Teaching and Learning Materials

This theme focuses on how the selected TLMs were put into practice during classroom instruction. It considers the execution of the lesson and actual use of the video suite during the interactions between the teacher and learners.

During her lesson, Happy played the video suite featuring a recorded presentation on parallel and series circuits. Her intention was to intercalate the video with deliberate pauses, using these moments to amplify and reinforce key concepts, clarify complex points, and draw attention to information she deemed critical for learner understanding. Reflecting on her implementation, she acknowledged, "Yeah, I was supposed to pause more often. Because I only paused once. I only paused in aspects where I'm like, this is what I needed them to see, and then I should have paused mostly because I felt like we were just watching, and then I was not explaining."

This reflection revealed Happy's growing awareness of the limitations in her sense-making process, particularly in how she navigated the use of the video suite as a pedagogical tool. While she had intended to interweave her own commentary with the video content to create a dynamic and participatory learning experience, the execution fell short of her aspirations. Instead of fostering an interactive and reflective environment, the session unintentionally reverted to a passive viewing exercise, with minimal learner engagement and limited opportunities for real-time sense-making. Happy's response highlights a failure in her sense-making process to consider the effective use of the video as a pedagogical resource. It also points to a developing use of the tool, which resulted in a missed opportunity to fully leverage the available infrastructure to enhance the learning experience. Figure 1 below illustrates Happy's sense-making process during the implementation of the TLM.
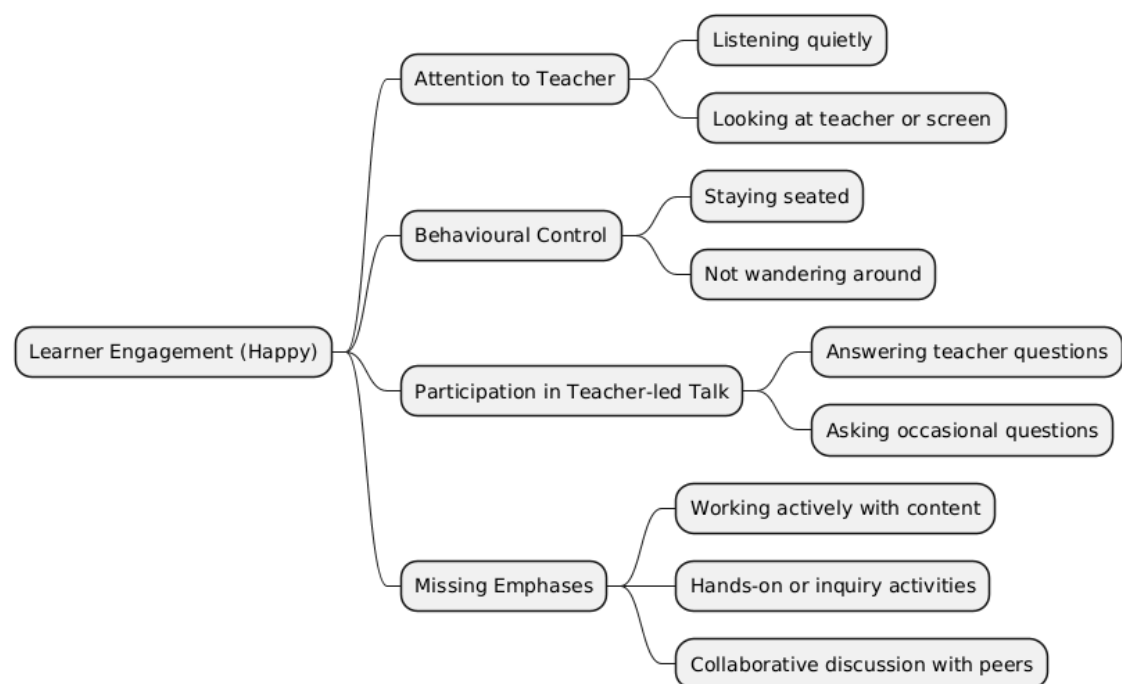
Figure 1. Sense-Making Process

Instead of projecting the video on a larger screen for the entire class to view simultaneously, Happy invited the learners to gather around her laptop to watch the presentation. This decision significantly limited the visibility and accessibility of the content, particularly for learners standing further away. When asked why she did not make use of a projector or larger display, Happy explained, "I don't know if we are allowed to use it. I'll just ask my mentors. So, it's only available in the hall. The hall has a facility where you can project. It's just a matter of me asking if I can conduct my class there."

The use of a larger screen could have supported greater learner engagement, improved visibility, and facilitated a more inclusive and communal viewing experience. This would have aligned with her sense-making intentions when planning to use the tool: to keep learners focused on the screen, ensuring everyone could both see and hear the content being presented. Nonetheless, her openness to exploring alternative venues, such as the hall, indicates a willingness to adapt and improve future lessons through better planning and resource utilization.

Adaptations and Modifications

This theme captures the adjustments Happy intended to make to her initial lesson plans in response to emerging learner needs and contextual challenges during teaching. In an effort to make the use of video content more engaging for students, the researcher recommended that Happy design

worksheets for learners to complete while watching the videos. This suggestion was offered in response to her question: "Where could I have improved if I wanted to use a video for my assessment? What would you advise me to not do or to do?"

This strategy aimed to encourage active listening and accountability. Reflecting on this suggestion, Happy responded: "And when you suggested that I should incorporate worksheets more often, it made a lot of sense because in my mind, I felt like [when I was teaching], it went well, but I cannot really prove it. It's like, if you were to ask me to show you evidence of whether the video went well, I can't prove it."

This reflection followed her earlier assertion that learners had understood the lesson, revealing a tension between her perception of success and the absence of concrete evidence to support it. Her response suggests a growing awareness of the limitations in her initial sense-making. She realized that it would be impossible to determine whether the gap she was facing had been bridged when there was no tangible evidence of learner engagement and learning outcomes.

Discussion

The analysis revealed that the pre-service teacher's (Happy's) selection and use of a video suite for teaching electric circuits was guided by intertwined pedagogical, epistemic, and affective motivations. Pedagogically, she viewed the video simulation as a tool to render abstract concepts like electric current flow and circuit configuration more concrete and accessible. Epistemically, she believed visualising electron movements and current splits would deepen student understanding, a belief seemingly confirmed by students' excited reactions. Affectively, her own negative experiences as a student—characterised by rigid, authoritarian classroom atmospheres—inspired a desire to create a relaxed, engaging, cinema-like learning environment. However, implementation diverged from these aspirations: the video was played with only a single pause, minimal teacher commentary, and students crowded around a laptop rather than viewing on a large screen. As a result, the session resembled passive viewing more than an interactive learning experience. Recognising this, Happy expressed the need for more structured engagement and asked for guidance. She later considered integrating worksheets and better infrastructure to support more interactive, participatory learning.

These results echo earlier studies demonstrating the effectiveness of interactive multimedia in improving conceptual understanding of electricity when well implemented. For instance, research on mobile interactive multimedia for prospective science teachers showed improved conceptual and problem-solving skills after engagement with dynamic visualisations of electric phenomena (Widodo et al., 2023). Similarly, meta-analyses of virtual labs and interactive simulations in STEM education report positive impacts on student learning outcomes, engagement, and conceptual clarity (Kefalis et al., 2025). The

current study adds to this body by documenting how a teacher's personal history and affective motivations drive tool selection—an aspect less emphasised in prior research, which often focuses on student outcomes or technical aspects of media use. At the same time, findings align with literature cautioning that the mere presence of video or simulation does not guarantee deep learning; effectiveness depends on how the tool is integrated through guided mediation, segmentation, and scaffolding (Chekour et al., 2022). The divergence between expected engagement and actual passive viewing underscores gaps identified in prior work regarding teacher readiness, infrastructure constraints, and teacher-centered definitions of engagement (Gonzales & Gonzales, 2024).

This study shows that the design of interventions for digital tool use requires attention to pre-service teachers' affective orientations and personal trajectories. Teacher educators in Islamic or general teacher-training programs cannot assume that the introduction of video or simulation will directly enhance instructional quality. They need to guide teachers in planning how digital resources will be mediated and integrated into lessons, for example by encouraging purposeful pauses, interactive tasks, or the use of larger displays to support clarity. The analysis also indicates the importance of embedding formative assessment procedures, such as worksheets or concept questions, to obtain concrete evidence of student learning rather than relying on assumptions drawn from student enthusiasm. The findings open a path for further inquiry into how cycles of reflection, feedback, and adaptation shape teachers' evolving sensemaking and how these processes might foster stronger student engagement and conceptual understanding. Evaluations of digital interventions therefore need to document not only student outcomes, but also shifts in teacher practice, patterns of material use, and classroom organisation that emerge over time.

The findings underscore that integrating digital teaching materials in physics classrooms requires more than technical availability: it involves aligning teacher motivation, identity, pedagogical vision, and infrastructural affordances. By foregrounding affective motivations and personal teaching histories, the study broadens prevailing narratives of digital media integration that prioritize cognitive and technical dimensions. The documented misalignment between aspiration and enactment reveals how easy it is for well-intentioned innovations to revert to passive, teacher-centred modes without deliberate scaffolding. Through this, the study advances theory by demanding a more holistic model that combines sensemaking, socio-material affordances, and reflective practice. For practice, the study calls for teacher education programmes and school policies that support not only access to digital tools, but also guidance in their meaningful pedagogical use, infrastructure readiness, and assessment practices.

CONCLUSION

This study examined how a pre-service teacher made sense of teaching and learning materials in a resource-constrained school context. The findings

revealed that her decisions were shaped by limited pedagogical understanding, prior experiences, and a narrow view of learner engagement. The video suite, although offering strong potential to support conceptual learning, was used in a passive and unstructured way. This resulted in minimal learner interaction and an absence of evidence showing conceptual understanding. Her reflections demonstrated emerging awareness of the weaknesses in her approach and the need for more purposeful planning, structured guidance, and assessment-oriented use of materials.

The study contributes to the existing body of knowledge by offering a detailed account of sense-making processes among pre-service teachers working in under-resourced environments. It shows how inadequate support and limited pedagogical framing can restrict the meaningful use of digital tools. The study highlights the importance of professional learning communities to develop teachers' capacity to integrate materials effectively during teaching practice. Future research may explore how structured mentorship, collaborative reflection, and modelling by experienced teachers can strengthen pre-service teachers' understanding and application of teaching resources.

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