

EXPLORING TEACHERS' EXPERIENCES IN USING COGNITIVE DIAGNOSTIC
ASSESSMENT IN PRIMARY SCHOOLS IN LESOTHO

BY

MOIPONE MOKHETHI

STUDENT NUMBER: 202103113

**A dissertation submitted to the Department of Educational Foundations, Faculty of
Education, in partial fulfilment of the requirements for the award degree of Master of
Education (Testing and Measurement) at the**

National University of Lesotho, Lesotho

SUPERVISOR: Dr. Musa Adekunle Ayanwale

August 2025

ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to everyone who supported me throughout this study, from its inception to its completion. First and foremost, I am thankful to God, the Almighty, for granting me the strength to undertake this research.

I am immensely appreciative of my supervisor, **Dr Musa Adekunle Ayanwale**, for not only teaching me research methods but also for his unwavering support and guidance during this study. His feedback was consistently encouraging and beneficial. I must also acknowledge my lecturers for their constructive criticism during the presentations of my research proposal.

I am grateful to the school principals (primary) for allowing me to interview their teachers. Special thanks go to the teachers who participated in the interviews and shared their experiences despite their busy schedules. I cannot forget my principal, who always permitted me to conduct interviews during working hours.

I am also thankful to my parents, Mrs. Mamoipone Rannoko and Mr. Mojalefa Rannoko, for keeping me in their prayers and taking care of my children while I was engaged in this study.

Lastly, I owe my deepest appreciation to my husband, Mr. Mokhethi Mokhethi, for being my pillar of strength and for believing in me. To my two children, Katleho and Relebohile Mokhethi, thank you for your understanding, as I was unable to spend much time with you.

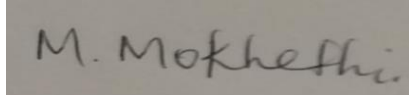
To everyone who contributed to this study in any way, I extend my sincere gratitude.

DEDICATION

I dedicate this work to my father, whose love for education and belief in my potential made this journey possible. Thank you, Dad, for believing in me.

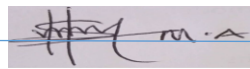
DECLARATION

I, Moipone Mokhehi, 202103113, declare that the research titled ‘Exploring teachers’ experiences in using Cognitive Diagnostic Assessment in primary school in Lesotho’ is my original work and has not been submitted to any other institution for qualification. References used in this study have been acknowledged and listed in the references section.

A rectangular box containing a handwritten signature in black ink that reads "M. Mokhehi".

CERTIFICATION

This is to certify that this dissertation has been thoroughly reviewed and approved to meet all the requirements set by the Faculty of Education, National University of Lesotho, for the award of Master of Education (M.Ed.).



SUPERVISOR

DR MUSA ADEKUNLE AYANWALE

HEAD OF DEPARTMENT

DR RETŠELISITSOE MATHEOLANE

DEAN OF THE FACULTY OF EDUCATION

PROFESSOR ANDREW PASEKA MOSIA

ABSTRACT

In the current global education landscape, there is an urgent need for assessment approaches that transcend summative grading to foster deep and personalised learning. In Lesotho, assessment practices remain predominantly traditional, relying heavily on recall-based tests that provide limited insight into learners' conceptual understanding or individual needs. This has hindered teachers' capacity to tailor instruction effectively and improve learning outcomes. Cognitive Diagnostic Assessment (CDA) presents a viable alternative, enabling teachers to pinpoint specific strengths, weaknesses, and misconceptions, thereby facilitating targeted instructional interventions. However, there is limited research on the experiences, perceptions, and challenges faced by teachers in integrating CDA into classroom practice within Lesotho's context.

Guided by Social Cognitive Theory, this qualitative study explored how practising teachers implement CDA, their perceptions of its effectiveness in enhancing classroom assessment, and the challenges encountered alongside adaptive strategies. Eight teachers from peri-urban and urban schools in Botha-Bothe and Maseru districts participated. With two participants from each of four schools. Purposive sampling was used to select these teachers. Data were collected over three months using semi-structured interviews, classroom observations, and document reviews. Thematic analysis, supported by Atlas.ti (version 24.1.0), was employed to identify emergent themes on teachers' experiences with CDA. Research trustworthiness was ensured through triangulation, member checking, prolonged engagement, and reflexivity.

Findings indicate that CDA has clearly deepened teachers' understanding of individual learner profiles, enabling more responsive, learner-centred, and evidence-based instructional planning. Teachers reported that CDA aligns with the national curriculum, strengthens formative assessment, and enhances learner engagement and performance. Additionally, CDA facilitated the identification of conceptual gaps, improved remediation strategies, and promoted active learning through flexible grouping. However, integration of CDA faced some challenges, including inadequate training, limited resources, overcrowded classrooms, high learner diversity, and heavy

workloads. Teachers adopted adaptive strategies such as low-tech tools, collaborative resource-sharing, embedding CDA in lesson plans, and flexible grouping to mitigate challenges.

The study concludes that CDA is a transformative approach with the potential to enhance teaching effectiveness and learner achievement in Lesotho's basic education system. For sustained impact, institutional support is critical, particularly through professional development, resource provision, and policy-level integration of CDA into curriculum guidelines. This study contributes to discourse on contextually relevant assessment reform in developing countries and calls upon the Ministry of Education and Training (MOET), the National Curriculum Development Centre (NCDC), and school leaders to prioritise CDA capacity-building, embed its principles in teaching practice, and create enabling environments for its implementation. Such measures can advance the education system towards more equitable, personalised, and impactful learning experiences. The study recommends that, MOET and NCDC should Strengthen CDA Training and Professional Development.

Keywords: Cognitive Diagnostic Assessment, formative assessment, learner-centred instruction, assessment reform, Lesotho education, teacher perceptions, qualitative study, Social Cognitive Theory

ACRONYMS

CDA	Cognitive Diagnostic Assessment
CDM	Cognitive Diagnostic Models
C-RUM	Compensatory reparameterised unified model
DINA	Deterministic inputs, noisy “and” gate
DINO	Deterministic inputs, noisy “or” gate
NIDA	Noisy -input, deterministic “and” gate
G-DINA	Generalised deterministic input “and” gate
ACDM	Addictive cognitive diagnostic models
LCDM	Log-linear cognitive diagnostic model
LLTM	Linear Logistic Test Model
MOET	Ministry of Education and Training
DA	Diagnostic Assessment
ECOL	Examinations Council of Lesotho
NCDC	National Curriculum Development Centre
ECE	Early Childhood Education
SDG	Sustainable Development Goals
CAP	Curriculum and Assessment Policy
NE	National Examinations
PSLE	Primary School Leaving Examinations
COSC	Cambridge Overseas School Certificate
LGCSE	Lesotho General Certificate of Secondary Education

LBCEP	Lesotho Basic Education Curriculum Policy
CASS	Continuous Assessment
SCT	Social Cognitive Theory
ESL	English as a Second Language
IELTS	International English Language Testing System
TIMSS	Trends in International Mathematics and Science Study
DCRCA	Diagnostic Chinese Reading Comprehension Assessment
OMC	Ordered Multiple Choice

LIST OF FIGURES

- Figure 2.1 Proposed Africanised CDA framework model
- Figure 4.1 Teachers' experiences with implementing CDA in classroom practice
- Figure 4.2 Enhanced Awareness of Learners' strengths and weaknesses
- Figure 4.3 Individualised instruction and learner-centered adaptation
- Figure 4.4 Teachers' motivation for incorporating CDA into their teaching practices
- Figure 4.5 Teachers' motivation for incorporating CDA into their teaching practices
- Figure 4.6 Desire to understand and address individual learning needs
- Figure 4.7 Specific integration of CDA to diagnose and address specific learning challenges
- Figure 4.8 Using CDA to adjust instruction and support learner growth
- Figure 4.9 Using CDA to identify specific conceptual or skill-based gaps in subject areas
- Figure 4.10 Barriers to effective implementation of CDA in the classroom
- Figure 4.11 Learner diversity and large class size and inadequate resources and training
- Figure 4.12 Time constraints and teacher workload
- Figure 4.13 Positive transformations in teaching and learning through CDA
- Figure 4.14 Enhanced instructional planning and responsiveness to learner' needs
- Figure 4.15 Improved student engagement, motivation and academic outcomes
- Figure 4.16 Effective strategies for implementing CDA into instructional planning
- Figure 4.17 Continuous, embedded assessment aligned with learning objectives
- Figure 4.18 Learner centered grouping and active engagement approaches
- Figure 4.19 Perception of CDA as a superior alternative to traditional methods

- Figure 4.20 Deeper diagnostic insights and individualised learning support
- Figure 4.21 Timely, formative feedback for improved assessment practices
- Figure 4.22 CDA as a transformative tool for responsive and informed assessment practices
- Figure 4.23 Enhanced questioning and depth in assessment strategies
- Figure 4.24 Informed and individualised instruction planning
- Figure 4.25 Using CDA to reveal learners' specific cognitive patterns and instructional needs
- Figure 4.26 Identifying conceptual misunderstanding and weaknesses
- Figure 4.27 Recognising learners' strengths and skill mastery
- Figure 4.28 CDA as a catalyst for deep conceptual understanding and learner growth
- Figure 4.29 Enhancing critical thinking and conceptual engagement
- Figure 4.30 Personalised support and instructional adjustment for learner mastery
- Figure 4.31 Benefits of CDA for informed, targeted and responsive instruction
- Figure 4.32 Diagnostic insight and tailored intervention
- Figure 4.33 Improved engagement and learner environment
- Figure 4.34 Informed lesson planning and instructional alignment
- Figure 4.35 Observed challenges or limitations in using CDA to support student learning outcomes
- Figure 4.36 Primary challenges in integrating CDA into classroom practice
- Figure 4.37 Insufficient training and limited resources
- Figure 4.38 Overcrowded classroom and high learner diversity
- Figure 4.39 Time and workload demands
- Figure 4.40 Teachers' adaptive strategies for navigating resources and logical constraints in implementing CDA

- Figure 4.41 Flexible planning and creative workarounds
- Figure 4.42 Leveraging low-tech and readily available resources
- Figure 4.43 Self-directed learning and online research
- Figure 4.44 Resistance or scepticism from colleagues or administrators regarding the use of CDA
- Figure 4.45 Adaptive strategies for overcoming challenges in implementing CDA
- Figure 4.46 Collaborative support and resource optimization
- Figure 4.47 Remedial and extra instructional time
- Figure 4.48 Strategic learner grouping or efficient remediation.
- Figure 4.49 Aligning CDA with curriculum and instructional objectives
- Figure 4.50 Designing CDA task based on curriculum learning outcome
- Figure 4.51 Integrating CDA into instructional planning and assessment strategies
- Figure 4.52 Collaborative practices to enhance the implementation of CDA
- Figure 4.53 collaborative practices to enhance the implementation of CDA

LIST OF TABLES

Table 1.1	Academic stream
Table 1.2	Technical stream
Table 1.3	Vocational stream
Table 1.4	Performance by districts from 2022-2023
Table 3.1	Characteristics of participating schools and teachers
Table 3.2	Week-by- week Training overview
Table 4.1	Participant information

Contents

EXPLORING TEACHERS' EXPERIENCES IN USING COGNITIVE DIAGNOSTIC ASSESSMENT IN PRIMARY SCHOOLS IN LESOTHO.....	i
ACKNOWLEDGEMENTS.....	i
DEDICATION.....	ii
DECLARATION.....	iii
CERTIFICATION.....	iv
ABSTRACT.....	v
ACRONYMS.....	vii
LIST OF FIGURES.....	ix
LIST OF TABLES.....	xii
1.0 INTRODUCTION.....	1
1.1 BACKGROUND TO THE STUDY.....	2
Table 1.1 (Academic stream).....	4
Table 1.2 (Technical stream).....	4
Table 1. 3: Alternative Stream.....	5
Table 1. 4 shows performance by districts from 2022-2023.....	9
1.2 STATEMENT OF THE PROBLEM.....	15
1.3 RESEARCH OBJECTIVES.....	16
1.4 RESEARCH QUESTIONS.....	16
1.5 SIGNIFICANCE OF THE STUDY.....	17
1.6 SCOPE OF THE STUDY.....	18
1.7 LIMITATIONS OF THE STUDY.....	18
1.8 DELIMITATIONS OF THE STUDY.....	18
1.9 DEFINITION OF TERMS.....	19
1.10 Literature review.....	19

1.10 .1Theory Underpinning	19
1.10.2 Empirical literature	27
1.11 METHODOLOGY	29
1.11.1 RESEARCH PARADIGM.....	29
1.11.2 RESEARCH DESIGN.....	30
1.11.3 RESEARCH APPROACH.....	30
1.11.4 METHODS OF DATA GENERATION	31
1.11.5 DATA ANALYSIS	33
1.12 TRUSTWORTHINESS IN RESEARCH	34
1.13 ETHICAL CONSIDERATION ON DATA COLLECTION	36
1.14 DISSERTATION OUTLINE.....	37
1.15 Conclusion.....	37
CHAPTER TWO	39
LITERATURE REVIEW	39
2.0 INTRODUCTION.....	39
2.1 THEORETICAL BACKGROUND	39
2.2 CONCEPTUAL REVIEW	46
2.2.1 EDUCATIONAL SYSTEM OF LESOTHO	47
2.2.2 ASSESSMENT IN EDUCATION.....	49
2.2.3 Cognitive Diagnostic Assessment (CDA)	50
2.4 EMPIRICAL LITERATURE.....	56
CDA in Language Education and Differentiated Instruction	61
2.4 APPRAISAL OF LITERATURE AND GAP.....	74
2.5 Conclusion.....	77
CHAPTER THREE	79

RESEARCH METHODOLOGY	79
3.0 INTRODUCTION	79
3.1 RESEARCH PARADIGM.....	79
3.2 RESEARCH DESIGN	82
3.3 RESEARCH APPROACH.....	84
3.4 STUDY AND PARTICIPANTS CONTEXT	84
Table 3.1	85
3.5 BASELINE ASSESSMENT	86
Table 3.2.....	88
3.6 SAMPLING TECHNIQUE AND SAMPLE	90
3.7 METHODS OF DATA GENERATION	92
3.7.1 In-Depth Semi-Structured Interviews.....	92
3.7.2. Classroom Observations	94
3.7.3. Document Review	95
RESEARCH TRUSTWORTHINESS.....	97
3.8.1. Transferability	97
3.8.2. Confirmability	97
3.8.3. Dependability.....	98
3.8.4. Credibility.....	98
3.9 METHOD OF DATA ANALYSIS.....	99
3.10 ETHICAL CONSIDERATIONS	101
CHAPTER FOUR.....	103
DATA ANALYSIS AND FINDINGS	103
1.0 INTRODUCTION	103
Table 4.1. Participant Information	103

CHAPTER FIVE	196
DISCUSSION ON FINDINGS.....	196
5.0 Introduction.....	196
CHAPTER SIX.....	205
SUMMARY OF FINDINGS, CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FUTURE DIRECTIONS	205
6.0 Introduction.....	205
6.1 Summary of Findings	205
6.2 Implications	207
6.3 Conclusion.....	208
6.4 Recommendations for research, practice and policy.....	208
6.5 Limitations	210
6.6 Future Directions.....	210
References.....	211
APPENDIX 1; INTERVIEW GUIDE	226
APPENDIX 2; CODE REPORT	228
APPENDIX 3 INTRODUCTORY LETTER FROM NATIONAL UNIVERSITY OF LESOTHO	248
APPENDIX ;4: LANGUAGE EDITING CERTIFICATE.....	249
APPENDIX 5; SIMILARITY INDEX FROM TURNIT PLAGERISM CHECKER.....	250
APPENDIX 6; OBSERVATION GUIDE	251
APPENDIX 7; Consent letter from school principals	252
APPENDIX 8; TEACHERS’ CONSENT LETTER	254

CHAPTER ONE

1.0 INTRODUCTION

Assessment remains a cornerstone of effective teaching and learning, serving not only as a mechanism for evaluating attainment but also as a means of informing instructional practice. In many educational systems, however, traditional assessments have largely been summative in orientation, privileging the measurement of outcomes over the diagnostic exploration of learning processes. This has often resulted in limited opportunities to identify and address learners' misconceptions in real time. In the context of Lesotho, where education reform has placed increasing emphasis on formative and learner-centered approaches through the Lesotho Basic Education Curriculum and Assessment Policy (LEBCP), the need for assessment practices that go beyond rote memorization has become particularly urgent (World Bank,2019)

Cognitive Diagnostic Assessment (CDA) has emerged internationally as a promising alternative that offers teachers detailed insights into learners' strengths and weaknesses across specific cognitive domains. Rather than producing a single score, CDA provides nuanced diagnostic information that can be used to guide remediation and enhance instructional decision-making (Shi et al.,2024; Peng et al.,2023). Such an approach resonates strongly with the aims of the LEBCP, which underscores the importance of formative feedback, inclusivity, and the cultivation of critical thinking skills. Yet, while CDA has been validated in multiple international contexts, its application within African education systems remains limited. The present study, therefore, explores how practicing teachers in Lesotho engage with CDA in their classroom, seeking to understand both its potential and its challenges.

The significance of this enquiry lies in the recognition that African education systems face distinct contextual realities, including overcrowded classrooms, linguistic diversity, and resource constraints (Rakolobe,2024; Kurata et al.,2022). These realities demand assessment models that are not only theoretically robust but also practically adaptable. By examining teachers' lived experiences of CDA, this study provides insights into how diagnostic assessment can be integrated into everyday practice in ways that are sensitive to such contextual demands. Moreover, it contributes to ongoing scholarly conversations about the localization of assessment frameworks, moving beyond Eurocentric traditions to approaches that foster problem-solving, adaptability, and learner empowerment within African classrooms (Letseka,2022). Against this backdrop, the study

is guided by three key research questions, and in pursuing these questions, the study seeks to contribute both to academic scholarship and to educational practice. By situating CDA within the lived realities of Lesotho teachers, it aims to provide evidence that informs teacher training, curriculum development, and policy reforms, while also offering a conceptual framework for the Africanisation of diagnostic assessment practices.

1.1 BACKGROUND TO THE STUDY

The Ministry of Education and Training (MOET) is mandated with delivering high-quality educational services to all Basotho, as stipulated in the Education Sector Plan 2016–2026. Mukurunge (2019) underscores that education constitutes a fundamental right that must be accessible to every child, irrespective of socio-economic background, thereby affirming that children from disadvantaged households are equally entitled to quality education. In 2009, the Ministry of Education and Training (MOET) introduced the Curriculum and Assessment Policy (CAP 2009) to enhance basic education provision for all Basotho children. This policy framework encompassed the first ten years of compulsory schooling, followed by the final two years of secondary education (Grades 11 and 12), positioning basic education as a foundational pathway to secondary schooling. Additionally, the Primary School Leaving Examination (PSLE) was replaced by the National Examination (NE), while the Cambridge Overseas School Certificate (COSC) was superseded by the Lesotho General Certificate of Secondary Education (LGCSE), which was deemed academically superior (Moea, 2021).

However, the implementation of CAP 2009 encountered significant challenges, including resource constraints, inadequate teacher training, disparities in access to quality education, and linguistic diversity (LBEC, 2021). Further, Moea (2021) highlights the lack of textbooks for both teachers and learners, an unwieldy syllabus structure, and time pressures, particularly as high school teachers were expected to deliver a five-year syllabus within four years. Further complications arose from teachers' difficulties in effectively utilising portfolios as an assessment tool (Chere-Masopha & Mothiba, 2022).

These systemic shortcomings eroded parental confidence in Lesotho's education system, which was increasingly perceived as ineffective, particularly as struggling learners were routinely promoted to subsequent grades with minimal intervention (Chere-Masopha & Mothetsi-

Mothiba,2022). Kabi (2015, cited in Moea, 2022) acknowledges that progression was only withheld in extreme cases, exacerbating concerns over educational standards.

In response to these challenges and in alignment with MOET's commitment to delivering equitable, quality education Lesotho transitioned from CAP 2009 to the Lesotho Basic Education Curriculum Policy 2021 (LBECP 2021). This shift sought to address the implementation gaps of CAP 2009 and to identify the factors contributing to its shortcomings. LBECP 2021 was designed to equip learners with the knowledge, skills, ethical grounding, values, and attitudes necessary for personal and professional survival.

Lesotho's education system is structured into three tiers: basic education, technical and vocational training, and higher education (LBECP, 2021). Basic education, which is both free and compulsory, comprises primary, secondary, and vocational pathways. Mukurunge et al. (2019) argue that primary education should establish a robust foundation to prepare learners for future academic or vocational pursuits. In Lesotho, primary education is segmented into foundation and intermediate phases. The foundation phase (Grades R–3) adopts an Integrated Curriculum (IC), which Ibrahimović (2017) characterises as an approach fostering holistic comprehension and enhancing engagement for both educators and learners. Within Lesotho's pedagogical framework, the integrated curriculum is favoured for its interdisciplinary emphasis.

In Grade R, instruction is organised into literacy, numeracy, and life skills, while Grades 1–3 incorporate literacy, numeracy, and environmental studies. From Grades 4–7, the curriculum transitions to discrete subjects, including First Language, Second Language, First Additional Language, Science, Mathematics, Creativity and Entrepreneurship, Life-Skills Sexuality Education, and Social Sciences some of which retain partial integration to facilitate progression into secondary education.

At the lower secondary level, the curriculum remains subject-based, with learners selecting either an academic or technical stream based on their Grade 9 performance and their school's curricular offerings from Grade 10. The upper secondary phase (Grades 10-12) is structured according to the learner's chosen specialisation. This dual-stream system aims to mitigate challenges faced by teachers by accommodating diverse learner aptitudes not all students are suited to the academic track, and the technical stream provides essential vocational competencies. The respective fields of study within the academic and technical streams are detailed in Tables 1.1 and 1.2.

Table 1.1(Academic stream)

Field of study	Mathematics and Science	Languages	Social sciences	Applied sciences	Commercial subjects	Technical subjects
Subjects	Biology, Physics, Chemistry, and ICT	Nguni languages, Literature in English, Foreign language, Sign language	Development studies, History, Geography, Global perspectives, Travel and Tourism, Religious studies	Agriculture, Food and Nutrition, Health and Physical Education, Fashion and Fabrics	Accounting, Business studies, Economics, Entrepreneurship, Computer technology	Design and Technology, Design and communication drawing, ICT
Compulsory subject	Sesotho, English, and Mathematics	Sesotho, Mathematics, Physical Science, English				

(LBECP 2021) source

As illustrated in Table 1.2, the technical stream comprises three distinct career pathways. Learners are required to select one specialised career pathway along with one elective subject, maintaining a minimum enrolment of seven subjects in total.

Table 1.2 (Technical stream)

Career paths	Technology	Travel and Tourism	Arts
Electives	Mechanical technology, Civil technology,	Food and Nutrition, Travel and Tourism,	Performing arts: Music, drama, dance Visual arts: Painting, modelling and

	Electrical technology	Hospitality Management	sculpture, enamel work, artistic drawing
Compulsory subjects	Sesotho, English, Entrepreneurship, Mathematics or Technical Mathematics, Physical science or Material science, Design and Communication Drawing.		

Source: (LBCEP, 2021)

The alternative stream (Table 1.3), designed to equip learners with pathways for further academic progression or direct entry into vocational employment, is termed the Vocational Stream. Learners who have not completed Grade 7 will enrol in Skills Training (Artisan Level 1), whereas those who have attained Grade 7 will enter Skills Training (Artisan Level 2), where they will cultivate foundational technical competencies. Upon completion of this stage, learners may advance to Vocational Training (Artisan Level 3) to develop specialised, higher-level skills. This structure ensures that participants are afforded opportunities to pursue further education at tertiary institutions or embark on their chosen vocational careers.

Table 1. 3: Alternative Stream

Skills development (artisan 1)	Computer literacy, Sewing, locksmith	Crop farming, livestock production, and masonry	Decorations, landscaping, and home care	Handicrafts
Skills training (artisan 2)	Technology Mechanical technology, civil technology, electrical technology, fashion and	Agricultural technology, natural resources, and environmental technology	Travel and tourism	Arts

	textiles technology			
Skills training (artisan 3)	Technology Mechanical technology, civil technology, electrical technology, fashion and textiles technology	Agricultural technology, natural resources, and environmental technology	Travel and tourism	Arts

Source: (LBECP, 2021)

Aligning Curriculum Goals with 21st-Century Competencies

To fulfil the objectives outlined in the *Lesotho Basic Education Curriculum Policy (LBECP)* (2021), it is imperative to equip learners with foundational competencies that facilitate the acquisition of 21st-century skills. Such an approach ensures learners are adequately prepared for contemporary societal and economic demands while maximising their developmental potential (Ministry of Education and Training [MoET], 2021). The curriculum identifies seven critical competency domains essential for holistic education in the modern era.

First, literacy and effective communication form the cornerstone of all learning, enabling students to articulate ideas cogently and engage critically with diverse sources of information (UNESCO, 2023). Second, functional and advanced numeracy skills provide the quantitative rigour necessary for analytical problem-solving in both academic and real-world contexts (OECD, 2022). Third, metacognitive strategies often termed "learning to learn" empower students to become autonomous learners capable of self-regulation and adaptive thinking (Zimmerman & Schunk, 2021). Fourth, personal and emotional skills development fosters resilience, self-awareness, and emotional intelligence, attributes increasingly recognised as pivotal for academic and professional success (Durlak et al., 2021).

Fifth, social and collaborative competencies prepare learners to navigate complex interpersonal dynamics and contribute meaningfully to collective endeavours (Pellegrino & Hilton, 2023). Sixth,

scientific, technical, and creative proficiencies cultivate the innovative and critical thinking demanded by an increasingly technology-driven global economy (World Economic Forum [WEF], 2022). Finally, digital literacy has emerged as an indispensable competency, enabling learners to harness technology ethically and effectively in both educational and professional spheres (European Commission, 2023).

Collectively, these seven domains constitute a robust framework designed to nurture well-rounded individuals capable of thriving in the rapidly evolving 21st-century landscape. The integration of these competencies into the curriculum reflects a progressive educational philosophy that prioritises not only academic rigour but also the cultivation of transferable life skills (MoET, 2021). This multifaceted approach acknowledges the intricate demands of contemporary society and seeks to prepare students to confront these challenges with both confidence and adaptability. By embedding these competencies throughout the curriculum, the *LBECP* (2021) aspires to transition Lesotho's education system from a traditional knowledge-transmission model to a dynamic, skills-based paradigm one that more effectively equips learners for the complexities of modern citizenship and employment (WEF, 2022).

Persistent Systemic Challenges in Lesotho's Education System

Despite these aspirations, Lesotho's education system continues to grapple with entrenched challenges, including resource constraints, linguistic diversity, and inequitable access to quality education. Many of these issues, initially identified during the implementation of *CAP 2009*, persist under *LBECP 2021*, underscoring systemic inertia in addressing structural barriers.

Resource Scarcity and Its Implications

Resource deficiencies pervade all educational tiers in Lesotho. The World Bank (2019) highlights overcrowded classrooms, insufficient pedagogical materials, demoralised teachers, and endemic poverty as critical impediments. A particularly acute issue is the shortage of secondary school classrooms to accommodate the influx of learners transitioning from primary education. Confirming, Maffea (2020) illustrate that this scarcity disproportionately burdens both teachers and students, stifling optimal learning conditions.

The absence of textbooks and supplementary materials exacerbates these challenges. Students frequently cannot complete homework due to restricted access to learning resources, while teachers struggle to deliver effective instruction (Makhate, 2020). Empirical evidence suggests a

correlation between resource deprivation and poor academic performance, with under-resourced schools consistently producing lower learner outcomes. Pedagogical materials are not merely ancillary; they are instrumental in knowledge acquisition, skill development, and learner motivation.

Comparative analyses reveal parallels with other jurisdictions, such as South Africa and Pennsylvania, where overcrowding and resource deficits have demonstrably compromised educational quality (Cloete, 2023; Maffea, 2023). These precedents suggest that Lesotho's resource gaps likely exert similarly deleterious effects on learner achievement.

Linguistic Diversity and Instructional Inequities

Lesotho's linguistic landscape further complicates educational delivery. While Sesotho dominates as the primary language, minority groups including speakers of IsiXhosa, Ndebele, Phuthi, and sign languages remain marginalised in curricular implementation. Although the *Lesotho Education Language Policy 2019* advocates for the inclusion of minority languages in schooling, operational adherence remains inconsistent. Research underscores the pedagogical benefits of mother-tongue instruction. Learners educated in their native language during foundational years exhibit superior academic progression, cognitive development, and engagement (Alieto, 2019; Nishanthi, 2020). Crucially, such an approach fosters cultural continuity, enhances parent involvement, and strengthens symbolic literacy (Cekiso et al., 2019).

However, policy-practice disjunctures persist. Koloti and Jita (2021) attribute this to inadequate teacher training on medium-of-instruction guidelines, particularly in early childhood education (ECE). Despite policy mandates for mother-tongue instruction in Grades R-3, many teachers default to Sesotho, disadvantaging linguistic minorities. This disparity is starkly evident in Quthing District, where IsiXhosa-speaking learners receive instruction in Sesotho a language of limited proficiency for them.

The consequences are quantifiable: Quthing consistently ranks among the lowest-performing districts in Lesotho's *General Certificate of Secondary Education (LGCSE)* examinations (*Examinations Council of Lesotho [ECOL]*, annual reports). This trend underscores the inextricable link between language-appropriate pedagogy and academic success.

Table 1. 4 shows performance by districts from 2022-2023

District (2022)	1. Qacha's nek	2. Mafeteng	3. Leribe	4. Mohaless' Hoek	5. Maseru	6. Thaba- Tseka	7. Botha- Bothe	8. Berea	9. Quthing	10. Mokhotlong
District (2023)	Mafeteng	Qacha's nek	Leribe	Thaba- Tseka	Maseru	Mohale s'hoek	Botha- bothe	Berea	Mokhotlong	Quthing

Source: ECOL district performance from 2022-2023

In nations characterised by linguistic diversity, such as Zimbabwe, Mampane (2006) observed that despite the official recognition of multiple languages mandated as media of instruction up to Grade 3, the implementation of this policy encountered significant challenges. Chief among these was the scarcity of teachers proficient in instructing learners in their respective mother tongues. This deficiency had a demonstrably detrimental impact on educational outcomes. By extension, a parallel concern arises in the context of Lesotho, where the absence of adequately trained teachers capable of delivering instruction in the mother tongues of minority linguistic groups may similarly compromise the quality of learners' education.

This assertion underscores a broader epistemological and pedagogical dilemma: the tension between linguistic pluralism as an educational ideal and the pragmatic constraints imposed by insufficient human capital to actualise such policies. The Lesotho case, like Zimbabwe's, illustrates how structural deficiencies in teacher training and deployment can undermine the ostensibly egalitarian objectives of mother-tongue education, thereby perpetuating educational inequities among linguistically marginalised cohorts.

Disparities in educational access and outcomes

In Lesotho, significant disparities exist in the allocation of educational resources across secondary schools, with pronounced inequalities in access to laboratories, libraries, and technological infrastructure (Lekhetho, 2021). This uneven distribution of facilities correlates strongly with geographical and socio-economic stratification, whereby urban institutions benefit from superior resourcing compared to their rural counterparts. Compounding this disparity, urban schools

predominantly cater to learners from more affluent backgrounds, affording them supplementary advantages such as internet access a critical enabler of educational attainment while rural schools contend with persistent infrastructural deficits that impede the delivery of quality education (Nofierepi & Masinire, 2021).

Guerra (2020) observes that poverty in Lesotho, as in many developing contexts, is spatially concentrated, resulting in high-poverty schools in rural regions. Capule-Navarro and Alampay (2020) further highlight that, within low- and middle-income countries, the absence of basic amenities including functional libraries, sanitation facilities, clean water, and electricity has been empirically linked to diminished academic performance. Electricity, in particular, is a pivotal resource, facilitating not only adequate lighting but also the integration of digital tools such as computers into pedagogical practices. Hitherto, in Lesotho, a substantial proportion of rural schools remain without electrification, exacerbating educational inequities.

The Role of Assessment in Enhancing Educational Quality

Assessment occupies a central role in Lesotho's educational strategy, as articulated in the *Lesotho Basic Educational Curriculum Policy 2021* (LBECP, 2021). The policy underscores the primacy of formative over summative assessment, reflecting a broader pedagogical shift towards continuous evaluation as a means of improving learning outcomes (Phosisi, 2019). Formative assessment, as Yigit and Culpepper (2022) assert, is integral to classroom dynamics, enabling teachers to monitor student progress in real time, deliver timely feedback, and adjust instruction to address learning gaps.

Within Lesotho's framework, formative assessment encompasses portfolios, continuous assessment (CASS), and structured checkpoints administered at key educational junctures. These checkpoints conducted at Grades 3, 7, and 9 serve diagnostic and evaluative functions, assessing core competencies in literacy, numeracy, Mathematics, Science, and English (LBECP, 2021). Their objectives are twofold:

Learner-Centric Insight: Enabling students to identify subject-specific strengths and weaknesses at the culmination of foundational, intermediate, and lower secondary phases.

Instructional Improvement: Providing teachers with actionable data to refine pedagogical approaches and enhance learning efficacy.

At Grade 12, assessment transitions to a summative public examination, utilising diverse modalities written tests, coursework, practical assessments, or project-based evaluations to determine eligibility for tertiary education.

The Pedagogical Significance of Classroom Assessment

Assessment constitutes a fundamental pillar of effective pedagogy, with teachers serving as primary agents in its implementation (Asamoah, 2024). Tontus (2020) conceptualises assessment as a systematic process of gathering and interpreting data to evaluate learners' knowledge, skills, and cognitive development. Mendoza (2020) extends this definition, framing assessment as the quantifiable documentation of academic proficiency, attitudinal dispositions, and skill acquisition.

Yousafzai (2020) assentuate the instrumental value of assessment in diagnosing learning deficiencies, informing instructional adaptations, and elevating both teaching efficacy and student performance. Well-designed assessments facilitate evidence-based decision-making, contributing to iterative improvements at the curricular, institutional, and systemic levels (Yambi, 2018). Moreover, Brown (2022) posits that robust assessment frameworks enable teachers to refine curricula, evaluate institutional quality, and benchmark systemic performance.

Subheesh and Sethy (2019) further elucidate the motivational dimension of assessment, noting that constructive feedback enhances learner engagement by fostering self-awareness of academic standing. This metacognitive insight not only bolsters student confidence but also incentivises deeper subject-matter engagement, thereby elevating overall educational quality.

Through systematic evaluation, teachers can effectively monitor students' learning trajectories, maintain comprehensive records of acquired knowledge, competencies, and skills, and identify persistent challenges (Sulaiman et al., 2020). This process enables the targeted remediation of concepts or procedures requiring reinforcement. Despite the centrality of assessment in contemporary pedagogy, few teachers receive rigorous, structured training in this domain (Sun, 2013). Consequently, many teachers lack the requisite expertise to deploy assessments optimally. As Gómez (2020) underscores, learning is shaped not merely by curricular content but equally by assessment methodologies, implying that the latter must be designed to facilitate deeper comprehension.

In Lesotho, however, traditional assessment paradigms remain dominant. These conventional approaches, reliant on pen-and-paper formats, afford learners scant opportunity for dialogue,

problem-based exploration, or analytical discourse (Mokotso, 2017). Such methods inhibit collaborative engagement with concepts, disadvantaging students who thrive in interactive learning environments. Quansah (2018) defines traditional assessment as standardised testing mechanisms yielding written outputs quizzes, examinations, and essays while Phongsirikul (2018) observes their limited efficacy in motivating learners or accurately gauging linguistic proficiency. Without insight into their strengths and weaknesses, students lack the metacognitive awareness necessary for self-directed improvement. Husain (2023) further critiques traditional methods for prioritising rote memorisation over genuine understanding, a sentiment echoed by Usman (2023), who acknowledges that students often reproduce memorised content without internalising the underlying skills.

Khalanyane (2014, cited in Chere-Masopha & Mothibe, 2022) argues that traditional assessments, by focusing on written responses, fail to illuminate students' cognitive processes, thereby obstructing pedagogical refinement. Teachers, confined to evaluating static outputs, struggle to discern mastered versus deficient skills, undermining their capacity to tailor support. Further, Mokotso (2017) adds that such assessments neglect 21st-century competencies collaboration, critical thinking, and problem-solving leaving students ill-equipped for real-world demands. Their rigidity also overlooks diverse learning modalities; as Lustgarten (2022) asserts, uniform assessments disregard individual preferences for tactile, visual, or kinaesthetic engagement, exacerbating inequities in learning opportunities. In Lesotho, the persistence of these methods restricts teachers' ability to assess engagement meaningfully, reducing assessment to a mechanistic exercise in grading rather than a diagnostic tool.

Given these limitations, alternative assessment frameworks are imperative to diagnose learners' proficiencies and gaps with precision. In addition, Brendefur (2018) advocates for methods capable of delineating specific skill deficits, thereby informing targeted interventions. Chin and Chew (2021) propose Cognitive Diagnostic Assessment (CDA) as a transformative alternative, enabling educators to pinpoint the cognitive processes underpinning student performance. By elucidating learners' cognitive architectures, CDA equips stakeholders to devise bespoke instructional strategies (Meng, 2022). Williamson (2023) characterises CDA as a mechanism for profiling skill acquisition, while Liu (2021) frames it as an automated means of evaluating proficiency through observable behaviours. Its granular feedback permits educators to design

interventions tailored to individual or group needs, as incorrect responses signal unmastered latent skills requiring remediation (Sun & Kanf, 2022).

Huang (2018) emphasises CDA's capacity to diagnose knowledge structures and processing gaps, distinguishing it from traditional assessments' reductive scoring. Unlike conventional methods, CDA yields multidimensional insights into cognitive barriers, enabling precise remedial action (Zhang et al., 2021). This learner-centred approach not only identifies struggles but also fosters deeper curricular engagement (Zhang et al., 2024).

Teachers in Lesotho predominantly rely on Continuous Assessment (CASS), portfolios, and checkpoint assessments, as advocated by the *Lesotho Basic Education Curriculum Policy (LBECP)* (2021). However, the efficacy of these tools is frequently undermined by implementation challenges. Chere-Masopha and Mothetsi (2022) identify several obstacles hindering the effective use of portfolios, including storage and safety concerns, limited teacher knowledge, excessive time demands, and large class sizes. Furthermore, Chere-Masopha (2022) argue that low teacher confidence often leads to perceptions of portfolios as ineffective. Similarly, Muskin et al. (2017) highlight resource constraints and insufficient training as pervasive barriers to CASS implementation in developing countries, a category that includes Lesotho.

The *LBECP* (2021) emphasises the cultivation of advanced linguistic and mathematical competencies to foster creativity, critical thinking, and lifelong learning. Cognitive Diagnostic Assessment (CDA) presents a viable means of achieving this objective, as it facilitates personalised instruction, enhances reflective teaching practices, and supports inclusive learning by delineating individual cognitive pathways. Its alignment with the curriculum's vision lies in its capacity to diagnose specific skill gaps, thereby enabling targeted pedagogical interventions.

Empirical studies from diverse contexts underscore CDA's transformative potential. Ekayati and Meisuri (2023) found that teachers perceived CDA as instrumental in informing differentiated instruction, with measurable impacts on classroom practice. This suggests that CDA could similarly enhance linguistic skill acquisition in Lesotho's English classrooms. For instance, before assigning a composition, teachers could diagnose foundational competencies such as word formation, punctuation, and sentence construction, ensuring learners possess the requisite skills for success.

Zeng's (2022) study in Canada further demonstrates CDA's utility in mathematics education, revealing disparities in skill mastery among learners. Applied in Lesotho, CDA could help teachers

identify deficiencies in arithmetic operations like addition and subtraction, enabling timely remediation before learners encounter more complex calculations. Beyond language and mathematics, CDA's applicability extends to subjects such as physics. Delga's (2019) research in Ethiopia revealed that learners often enter physics classes with entrenched misconceptions, which, if unaddressed, impede new learning. By diagnosing these misconceptions proactively, teachers can design remedial instruction to rectify misunderstandings a practice equally beneficial in Lesotho's classrooms.

CDA operates through Cognitive Diagnostic Models (CDMs), also termed Diagnostic Classification Models (DCMs). These models yield granular insights into learners' knowledge structures, skill proficiencies, and problem-solving strategies (Huang et al., 2022). Ravand et al. (2019) posit that CDMs elucidate the cognitive underpinnings of test performance, offering detailed feedback on why examinees succeed or fail specific items. Such diagnostic precision enables educators to tailor instruction to individual needs (Effatpanah, 2019). For example, Ren et al. (2021) employed CDMs to identify poorly mastered attributes in statistics education, while Jiao (2020) emphasises their role in furnishing policymakers with fine-grained data on student skill acquisition.

Given their capacity to generate actionable insights, CDMs have garnered significant scholarly attention (Rupp et al., 2010). Their adoption by teachers is increasingly widespread, as they transcend the limitations of traditional assessments by pinpointing cognitive strengths and weaknesses with unprecedented specificity. As a result, practicing teachers in Lesotho could leverage CDMs to diagnose skill mastery and devise targeted instructional strategies.

This study holds considerable significance, as it seeks to explore practicing teachers' experiences with CDA a domain underexamined in Lesotho's educational landscape. Javidanmeh and Sarab (2017) regard CDA as a paradigm shift in educational measurement, offering nuanced feedback on sub-skill proficiency within a given domain. Despite its nascent stage (Leighton & Gierl, 2009), CDA addresses a critical gap left by traditional assessments, which fail to provide cognitively diagnostic feedback. Its growing prominence is evidenced by large-scale implementations, such as Li Zhen and Liu's (2021) study involving 21,466 students, and Abani et al.'s (2022) findings on high CDA utilisation among 3,170 secondary teachers. Such precedents underscore the need to investigate Lesotho's teachers' experiences with this innovative tool.

Nevertheless, CDA remains underutilised in Lesotho, partly due to its perceived complexity, particularly regarding CDMs. A systematic inquiry into teachers' challenges, perceptions, and adaptive strategies is essential to inform effective implementation. Without such insights, the development of supportive frameworks will remain speculative.

Moreover, this research promises practical relevance. By elucidating teachers' firsthand experiences with CDA, it could demystify its application for teachers globally, including those in Lesotho. Policymakers, armed with empirical evidence of CDA's benefits, may advocate for its integration into national assessment frameworks. Crucially, embedding CDA within formative practices could preempt skill gaps before checkpoint assessments, ensuring learners advance with robust competencies.

This study will also enrich the nascent literature on teachers' engagement with innovative assessment methods. Given the paucity of research on CDA's practical implementation, its findings could guide future pedagogical and policy decisions, ultimately enhancing learning outcomes across contexts.

1.2 STATEMENT OF THE PROBLEM

The Lesotho Basic Education Curriculum Policy (LBECP, 2021) advocates for learner-centred and competency-based pedagogical approaches, explicitly endorsing formative assessment as a means of fostering deeper understanding. However, prevailing classroom assessment practices remain predominantly summative, disproportionately reliant on Continuous Assessment (CASS), portfolios, and terminal examinations that prioritise scoring over meaningful learning (Mokotso,2017). Such traditional assessments provide limited diagnostic insight into learners' cognitive processes, leaving teachers without the necessary granularity to identify specific skill deficiencies or proficiencies. In contrast, Cognitive Diagnostic Assessment (CDA) offers a transformative alternative, furnishing educators with fine-grained, actionable data on individual learning needs thereby enabling precisely tailored instructional interventions (Chin & Chew,2021; Sun & Kanf,2022).

Despite its theoretical promise, the global implementation of CDA remains nascent, with significant variability in its practical application across educational contexts. In Lesotho, CDA is seldom employed or even adequately understood by practicing teachers, and empirical research examining its real-world classroom implementation is strikingly absent. Existing scholarship has overwhelmingly centred on conventional assessment paradigms, resulting in a critical lacuna

regarding how CDA might be operationalised effectively within everyday teaching practice. Teachers, as the primary agents of pedagogical change, are pivotal to the successful adoption of innovative assessment methodologies; yet their perspectives, contextual challenges, and experiential realities are frequently marginalised in broader reform discourses.

Addressing this research gap is imperative for multiple reasons. Foremost among these is CDA's potential to fundamentally reshape assessment paradigms, equipping teachers with empirically grounded, diagnostic insights that facilitate truly differentiated and responsive instruction. Practicing teachers stand to gain substantially from a deeper engagement with CDA, as its principled application could enhance both the precision of their assessments and the efficacy of resultant teaching strategies.

Consequently, in the absence of robust empirical evidence elucidating teachers' first-hand experiences with CDA, any systemic efforts to mainstream or institutionalise diagnostic assessment risk being misaligned with classroom exigencies, ultimately rendering such initiatives unsustainable or ineffectual.

This study responds to an urgent imperative: to interrogate how practicing teachers in Lesotho conceptualise, negotiate, and enact CDA within the complexities of their distinctive educational milieux.

1.3 RESEARCH OBJECTIVES

The objectives of the study are as follows.

1. To explore practicing teachers' experiences with Cognitive Diagnostic Assessment (CDA)
2. To assess practicing teachers' perceptions on Cognitive Diagnostic Assessment (CDA) effectiveness
- 3.a) To identify challenges faced by practicing teachers in Lesotho classrooms when integrating Cognitive Diagnostic Assessment (CDA)
- b) To identify strategies in addressing these challenges

1.4 RESEARCH QUESTIONS

The study is set to answer the following research questions:

1. What are the experiences of practicing teachers in Lesotho classrooms regarding the implementation of cognitive diagnostic assessment (CDA)?
2. How do practicing teachers perceive the effectiveness and utility of Cognitive Diagnostic Assessment (CDA) in improving their assessment practices in Lesotho?
- 3.a) What are the main challenges faced by practicing teachers in Lesotho classrooms when integrating CDA into their teaching practices?
- b) What strategies do they employ to address these challenges?

1.5 SIGNIFICANCE OF THE STUDY

It was hypothesised that teachers would derive substantial professional benefit from this study, given their central role in implementing Cognitive Diagnostic Assessment (CDA) within classroom contexts and navigating its associated challenges. Resultantly, a positive shift in practicing teachers' perceptions of CDA was anticipated. Furthermore, it was postulated that such attitudinal changes might facilitate more effective classroom application, thereby enhancing both pedagogical delivery and learning outcomes.

This research has the potential to furnish teachers with empirically grounded insights to refine their assessment methodologies. For policymakers, the findings may necessitate the Ministry of Education and Training (MOET) to consider formalising CDA within national assessment frameworks. The study could serve as an evidence base to inform MOET's strategic reforms of evaluation systems.

Similarly, the research outcomes may yield actionable recommendations for the National Curriculum Development Centre (NCDC), particularly regarding curriculum design and teacher support mechanisms. The NCDC might leverage these findings to enhance pre-service training programmes and develop targeted continuing professional development initiatives.

A critical policy implication of this study lies in its potential to catalyse MoET-led initiatives promoting CDA adoption. This would require systematic efforts to build teachers' diagnostic assessment literacy through comprehensive capacity-building measures. Crucially, the implementation of such reforms would necessitate the organisation of sustained, high-quality

training workshops to equip practitioners with the requisite competencies for effective CDA utilisation in diverse classroom settings.

1.6 SCOPE OF THE STUDY

This study examined teachers' perceptions regarding the efficacy of Cognitive Diagnostic Assessment (CDA) in classroom settings. The investigation specifically explored: (1) teachers' views on CDA's effectiveness as an assessment tool; (2) implementation challenges encountered when utilising CDA; and (3) adaptive strategies employed to mitigate these difficulties.

The research adopted a qualitative case study approach across four primary schools in Lesotho, strategically selected to represent both urban and peri-urban educational contexts. The sample comprised two peri-urban institutions in Botha-Bothe district (northern Lesotho) and two urban schools in Maseru district. Participants included eight qualified teachers (two per school), selected through purposive sampling criteria emphasising: (a) substantive classroom assessment experience; (b) current engagement with diverse assessment methodologies; and (c) willingness to articulate their professional practices concerning CDA.

Data collection occurred through semi-structured interviews conducted after school hours on Fridays, complemented by classroom observations. The interview protocol employed open-ended questions designed to elicit detailed accounts of teachers' assessment experiences while allowing for emergent themes. This dual-method approach facilitated triangulation between reported perceptions and observed practices.

1.7 LIMITATIONS OF THE STUDY

The study was limited to eight teachers from only two districts (Botha-Bothe and Maseru), restricting the generalisability of the findings. CDA is still emerging in Lesotho, and participants had only 12 weeks of training before the study, which may have shaped their implementation experiences.

1.8 DELIMITATIONS OF THE STUDY

The study is delimited to exploring teachers' experiences in using cognitive diagnostic assessment (CDA) in primary schools in Lesotho in selected primary schools within Botha-Bothe (peri-urban) and Maseru (urban) districts. Four schools were selected. Two in Botha-Bothe and two in Maseru.

The participants included eight teachers, two per school. Only teachers who have received training on CDA were chosen. Newly employed teachers were excluded. The study focused on;

(1) teachers' views on CDA's effectiveness as an assessment tool; (2) implementation challenges encountered when utilising CDA; and (3) adaptive strategies employed to mitigate these difficulties. Learners' perspectives will not be addressed. A qualitative approach was adopted, using in-depth interviews, observation and document review. No quantitative data was collected. These delimitations were made to maintain a manageable scope within available time.

1.9 DEFINITION OF TERMS

**Cognitive* means relating to the mental process involved in knowing, learning, and understanding things.

**Assessment* is the process of evaluating and measuring students' understanding, skills, and progress concerning specific learning outcomes.

**Cognitive Diagnostic Assessment* is an assessment that is designed to assess specific knowledge structures and cognitive skills in students in order to provide information on cognitive strengths and weaknesses.

**Cognitive diagnostic models* are a class of discrete latent variable models that may be used to estimate the possession of attributes (skills).

**Practicing teacher* is a teacher who has certification or is already teaching in the classroom.

1.10 Literature review

1.10 .1 Theory Underpinning

This study is theoretically anchored in Bandura's (1986) Social Cognitive Theory (SCT), a seminal framework that examines learning as an interplay of cognitive, behavioural, and environmental factors. SCT posits that human development occurs through dynamic, reciprocal interactions between individuals and their sociocultural contexts (Bandura, 2001). Within educational settings, this perspective is particularly salient, as it underscores how observation, modelling, and self-regulatory processes shape pedagogical practices including teachers' adoption of innovative assessment methodologies such as Cognitive Diagnostic Assessment (CDA).

Observational Learning

Social Cognitive Theory (SCT) posits that human behaviour is substantially acquired through observational learning, wherein individuals assimilate novel competencies by witnessing modelled actions (Nabavi & Bijandi, 2012). Bandura (1977) suggests that observing colleagues achieve success in similar situations can enhance an individual's confidence in their own abilities. In educational contexts, practicing teachers may develop proficiency in Cognitive Diagnostic Assessment (CDA) by observing colleagues or mentors effectively employing these techniques in classroom settings. This vicarious learning process serves as a critical mechanism for disseminating innovative assessment practices across teaching communities. According to Furtado (2010), people learn a great deal by watching others. For instance, they can see how other teachers successfully apply CDA in their teaching environments.

Self-Efficacy

At the heart of Social Cognitive Theory (SCT) lies the fundamental construct of self-efficacy, conceptualised as an individual's firmly held belief in their ability to successfully perform the actions necessary to attain specific goals (Koutroubas & Galanakis, 2022). This psychological mechanism, first rigorously examined by Bandura (1977), has been consistently shown to exhibit a strong positive correlation with an individual's capacity to maintain perseverance when encountering obstacles.

When examining the implementation of Cognitive Diagnostic Assessment (CDA) in educational settings, the influence of teacher self-efficacy becomes particularly salient. Teachers who possess well-developed assessment self-efficacy demonstrate several characteristic behaviours that facilitate the successful integration of diagnostic methodologies. Such teachers typically exhibit sustained commitment to employing diagnostic assessment techniques even when faced with initial implementation challenges. Furthermore, they display a marked willingness to explore and test various assessment strategies, demonstrating intellectual flexibility in their pedagogical approach. Perhaps most significantly, these teachers show enhanced capacity to adapt to and adopt innovative assessment practices, viewing them as opportunities for professional growth rather than threats to established routines.

Teachers with a strong sense of self-efficacy exhibit greater resilience and a willingness to embrace change (Brinson & Steiner, 2007). In stark contrast, teaching professionals with underdeveloped assessment self-efficacy often manifest considerable resistance to adopting CDA approaches. This resistance frequently stems from doubts about their capability to master and effectively implement the new assessment paradigm. In consequence, such teachers may persist with traditional assessment methods, even when evidence suggests the superiority of diagnostic approaches. This tendency towards methodological conservatism potentially creates a significant barrier to educational innovation, as it reinforces the continued dominance of conventional assessment models that may be less effective in identifying and addressing individual student learning needs. The implications of these differential responses are profound for educational reform initiatives. According to Leung, Fung, and Chang (2025), enhancing professional development and resilience can lead to increased teacher efficacy. Therefore, institutions seeking to implement CDA successfully must therefore prioritise the development of teacher self-efficacy as a fundamental component of any professional development programme. This necessitates creating supportive environments that provide both the technical training and the psychological reinforcement required for teachers to develop confidence in their ability to utilise diagnostic assessment methods effectively. Only through such comprehensive approaches can educational systems overcome the natural resistance to change and facilitate the widespread adoption of more sophisticated assessment practices.

Modelling and Reinforcement

Social Cognitive Theory elucidates how human learning is substantially enhanced through two interrelated psychological processes: behavioural modelling and reinforcement. Bandura's (1986) seminal work demonstrates that when teachers observe competent peers or leaders effectively implementing Cognitive Diagnostic Assessment (CDA) strategies particularly when such exemplars are subsequently recognised for their professional expertise or achieve measurable improvements in student outcomes - a powerful vicarious learning effect occurs. This phenomenon significantly increases the probability of observational adoption among teaching staff.

These insights highlight two critical institutional requirements for successful CDA implementation. Firstly, the visible demonstration of exemplary diagnostic assessment practices by respected senior practitioners serves as an essential catalyst for professional learning. When experienced colleagues model the effective application of CDA techniques including the interpretation of diagnostic data and subsequent pedagogical adjustments they provide concrete, observable prototypes that less experienced teachers can emulate.

Secondly, the establishment of systematic reinforcement mechanisms proves fundamental to sustaining innovative assessment practices. Institutional recognition through formal professional incentives, coupled with constructive feedback loops that highlight the educational benefits of CDA implementation, creates an environment conducive to long-term methodological change. Such reinforcement structures not only validate early adopters but also signal organisational values, gradually reshaping collective assessment practices across the teaching community.

The interdependence of these factors' quality modelling paired with appropriate reinforcement creates optimal conditions for the organic dissemination of diagnostic assessment competencies throughout educational institutions. This dual approach addresses both the cognitive and motivational dimensions of professional learning, facilitating what Bandura termed "modeling through abstract representation" whereby teachers internalise general principles of effective assessment practice rather than simply copying specific behaviours. Resultantly, educational leaders seeking to implement CDA reforms must give simultaneous attention to cultivating exemplary practitioners and designing recognition systems that systematically reinforce desired assessment practices.

Reciprocal Determinism

The principle of reciprocal determinism provides a sophisticated framework for understanding the complex dynamics that shape teachers' adoption of Cognitive Diagnostic Assessment (CDA). This theoretical construct, as articulated by LaMorte (2022), posits a triadic relationship between three interdependent elements: personal cognitive factors, observable behaviours, and environmental

influences. Within educational contexts, this interaction manifests in several critical dimensions that collectively determine the success of assessment innovation.

Teachers' engagement with CDA cannot be reduced to mere individual capability; rather, it emerges from a dynamic interplay between internal dispositions and external conditions. Firstly, institutional culture plays a pivotal role school that foster a climate of pedagogical experimentation and value assessment literacy create fertile ground for CDA implementation. Conversely, environments resistant to methodological innovation may stifle even the most competent teachers' efforts to adopt diagnostic approaches.

Secondly, material and administrative support structures constitute essential enablers of sustainable practice. The availability of appropriate assessment resources, coupled with leadership endorsement and time allocation for diagnostic processes, significantly enhances teachers' capacity to integrate CDA effectively. Without such foundational support, even highly motivated practitioners may struggle to translate theoretical understanding into classroom application.

Thirdly, macro-level policy frameworks establish the parameters within which assessment innovation occurs. National education policies that explicitly endorse diagnostic assessment approaches and align them with curriculum objectives provide legitimacy and direction for teachers' professional experimentation.

Empirical observations consistently demonstrate that when school environments actively champion diagnostic assessment methodologies, teaching professionals exhibit markedly greater willingness to incorporate CDA into their instructional practices. This institutional endorsement, when combined with adequate resourcing and policy alignment, creates a virtuous cycle wherein teachers' successful implementation of diagnostic techniques reinforces both their self-efficacy and the school's commitment to assessment innovation. Ultimately, such systemic support not only facilitates teachers' methodological assimilation of CDA but also amplifies its positive impact on student learning trajectories.

The reciprocal determinism framework thus illuminates the necessity of addressing assessment reform at multiple levels simultaneously. Sustainable CDA implementation requires concurrent attention to individual teacher development, school culture transformation, and policy framework

alignment recognising that each dimension continually shapes and is shaped by the others in a dynamic educational ecosystem.

Theoretical Implications for the Study

Social Cognitive Theory (SCT) offers a comprehensive analytical lens through which to investigate the multifaceted process of Cognitive Diagnostic Assessment (CDA) adoption in classroom settings. The theory elucidates three critical dimensions that collectively shape teachers' engagement with innovative assessment practices.

First, SCT illuminates how observational learning mechanisms contribute to the dissemination of CDA methodologies among teachers. Through witnessing colleagues or mentors effectively employing diagnostic assessment techniques, teachers acquire both the conceptual understanding and practical skills necessary for implementation. This vicarious learning process proves particularly salient in Lesotho's educational landscape, where professional development opportunities may be limited. The theory suggests that structured observation of exemplary CDA practices could significantly accelerate adoption rates across teaching communities.

Second, the construct of self-efficacy emerges as a pivotal mediator in teachers' responsiveness to assessment innovation. SCT posits that teachers with strong beliefs in their capability to implement CDA successfully demonstrate greater persistence when encountering challenges. They exhibit increased willingness to experiment with diagnostic strategies and adapt them to diverse classroom contexts. Contrastingly, teachers plagued by self-doubt may resist abandoning familiar assessment approaches, even when presented with compelling evidence of CDA's benefits. This insight underscores the necessity of professional development initiatives specifically designed to build assessment-related self-efficacy among practitioners.

Third, SCT's principle of reciprocal determinism highlights the environmental factors that either facilitate or hinder sustainable CDA implementation. The theory demonstrates that teacher behaviour does not exist in isolation, but rather evolves through continuous interaction with institutional cultures, resource availability, and policy frameworks. Schools that provide adequate materials, administrative support, and positive reinforcement for diagnostic assessment use create

conditions conducive to successful CDA adoption. On the other hand, even highly motivated teachers may struggle to maintain innovative practices in unsupportive environments.

These theoretical insights yield several practical implications for educational reform. Schools should establish formal peer observation programmes that showcase effective CDA implementation, allowing less experienced teachers to learn through modeling. Professional development initiatives must move beyond technical training to address the psychological dimensions of assessment innovation, nurturing teachers' confidence in their diagnostic capabilities. At the institutional level, policymakers need to align resource allocation, performance metrics, and reward systems with the principles of diagnostic assessment.

Ultimately, SCT provides a nuanced framework for understanding the complex interplay between individual cognition, professional practice, and organizational context in educational innovation. By accounting for both psychosocial and structural factors, the theory offers a holistic perspective on the challenges and opportunities surrounding CDA implementation in Lesotho's classrooms. This comprehensive understanding proves essential for developing interventions that not only introduce new assessment methods but ensure their sustained and meaningful use in authentic teaching contexts.

The theory's emphasis on observational learning, self-efficacy, and environmental influences collectively provides a robust foundation for designing capacity-building initiatives that address the complete spectrum of barriers to CDA adoption. Rather than focusing solely on skill development, effective implementation strategies must simultaneously cultivate teachers' professional confidence and transform institutional conditions to support assessment innovation. Through this multidimensional approach, SCT informs the creation of sustainable pathways for improving classroom assessment practices across Lesotho's educational system.

Practical implications for the study

Peer modelling and observational learning opportunities-Teachers can learn about new assessment methods by observing others. Therefore, schools should promote collaborative learning environments where teachers can observe others and model the observed behaviours.

Professional development to enhance self-efficacy-Schools should provide teachers with workshops and training, especially on new assessment modes, in order to enhance their self-efficacy.

Cultivating supportive school environment- School administrators should provide necessary resources, recognise effective implementation, and foster a culture that values assessment innovation. Positive reinforcement such as professional recognition or tangible rewards can sustain motivation for CDA use. By integrating SCT, this study advances a nuanced understanding of the dynamic interplay between individual cognition, behaviour, and environmental factors in CDA implementation.

Towards an Africanised CDA Framework for Lesotho

While Cognitive Diagnostic Assessment (CDA) originates from psychometric traditions in the Global North, its adaptation to African contexts requires a deliberate integration of local realities, pedagogical traditions, and education policy priorities. In particular, CDA in Lesotho must be aligned with the Lesotho Basic Education Curriculum and Assessment Policy (LEBCP,2009; revised 2021), which emphasizes formative assessment, inclusivity, and problem -solving skills. An Africanised CDA framework, therefore, extends beyond cognitive profiling to incorporate social, linguistic, and cultural dimensions that shape learners' educational journeys.

First, the framework emphasis holistic learner profiling. Unlike conventional CDA,which often limits itself to discrete cognitive skills, an Africanised version acknowledges the role of language diversity, social-economic background, and community values in shaping learning outcomes. For example, diagnostic information in multilingual Lesotho classrooms must capture not only mastery of subject content but also how the language of instruction (English) intersects with learning barriers.

Second, the framework integrates context-responsive pedagogy. In African classrooms, where overcrowding and limited resources are common, CDA must be embedded into low-tech and teacher-friendly practices such as oral questioning, peer -learning groups, and observation-based checklists. This moves diagnostic assessment from being dependent on advanced psychometric software to being practical and sustainable in under-resourced environments (Matore & Noh,2023).

Third, the framework positions CDA as a tool for African problem-solving skills. Echoing the African Renaissance version (Mbele,2021), assessment must cultivate learners who can critically apply knowledge to solve local challenges such as food insecurity, climate resilience, and Public health. An Africanised CDA thus diagnoses not only whether learners can recall knowledge, but whether they can transfer it to real-life, community-based problem contexts.

Finally, the framework underscores collaborative teacher agency. Teachers are not passive implementers of externally designed diagnostic tools but active co-creators of assessment practices. Through professional learning communities, peer observations, and shared toolkits, teachers collectively refine CDA to reflect their learners' needs and

Lesotho's educational vision. This proposed framework Africanised CDA framework contributes to assessment theory by grounding CDA in African epistemologies of education, which value relationality, communal learning, and contextual problem-solving. It also provides a practical pathway for policymakers and practitioners in Lesotho to implement diagnostic assessments that are both globally informed and locally relevant.

1.10.2 Empirical literature

Emerging research demonstrates the efficacy of Cognitive Diagnostic Assessment (CDA) as a transformative pedagogical tool, with empirical studies highlighting its dual capacity to enhance learning outcomes and inform instructional decision-making (Ekayati & Meisuri,2023; Zeng (2022);Delga (2019). Given the relative paucity of literature specifically addressing classroom implementation, this analysis draws upon salient studies where researchers have operationalised Cognitive Diagnostic Models (CDMs) in authentic educational settings.

Wu's (2024) innovative study developed an AI-enhanced game-based learning environment incorporating real-time cognitive diagnosis, employing Bayesian networks to identify and address learners' mathematical misconceptions. The research cohort (N=56 secondary students) revealed a 90.8% diagnostic accuracy rate when validated against expert judgement. Notably, participants engaged in the personalised game-based intervention demonstrated significantly superior learning outcomes compared to counterparts using conventional multimedia problem-solving tasks. These findings substantiate three key benefits of embedded cognitive diagnostics: (1) enhanced conceptual problem-solving competencies, (2) increased learner motivation through targeted remediation, and (3) effective misconception rectification through adaptive content delivery.

Complementary research by Zeng (2022) in Ethiopia applied the Deterministic Inputs, Noisy "and" Gate (DINA) model to analyse PISA mathematical performance data. The study identified differential mastery levels across mathematical competencies, with applied mathematical thinking skills demonstrating the highest proficiency among Canadian learners.

This methodological approach holds particular relevance for Lesotho's educational context, where the systematic implementation of Cognitive Diagnostic Models (CDMs) could serve three critical functions: first, enabling the precise identification of specific skill gaps in mathematical understanding through granular diagnostic analysis; second, facilitating data-driven, targeted remedial interventions tailored to individual learners' demonstrated needs; and third, potentially elevating national mathematics performance metrics by addressing foundational competency gaps that currently hinder academic achievement. The integration of such diagnostic precision into Lesotho's assessment framework would represent a significant advancement beyond traditional evaluation methods, offering educators an evidence-based mechanism for improving both instructional strategies and learning outcomes in mathematics education.

The mechanistic precision of CDMs enables educators to transcend traditional assessment limitations by generating skill-specific proficiency profiles. Such granular data empowers teachers to develop precisely calibrated instructional responses rather than relying on generic remediation strategies. These studies collectively underscore CDA's transformative potential when properly implemented. Wu's research demonstrates how diagnostic technologies can personalise learning experiences, while Zeng's analysis illustrates CDMs' capacity to benchmark and improve domain-specific competencies. For Lesotho's education system, these findings suggest that strategic integration of cognitive diagnostics could address persistent learning gaps, particularly in STEM disciplines, through data-driven pedagogical interventions. The demonstrated efficacy of these approaches across disparate educational contexts warrants serious consideration for systemic implementation, pending contextual adaptation and teacher capacity development.

1.11 METHODOLOGY

This study employed a qualitative research methodology, an interpretive methodological approach. The study's methodological framework is structured and presented according to seven key components: (1) the research paradigm informing the philosophical orientation; (2) the research design outlining the overall strategy of inquiry; (3) the research approach specifying the procedural framework; (4) the method of data generation detailing techniques for evidence collection; (5) the method of data analysis describing systematic procedures for interpreting findings; (6) sampling considerations including participant selection criteria; and (7) sampling techniques explaining the specific methods employed for recruiting study participants. This comprehensive methodological structure ensures rigorous alignment between the study's epistemological foundations and its practical implementation.

1.11.1 RESEARCH PARADIGM

The research paradigm constitutes the fundamental philosophical framework that guides scholarly inquiry (Khatri, 2020). This study is situated within the interpretivist paradigm, which enables researchers to achieve substantive depth by examining the subjective experiences and perceptions of individuals within specific contexts (Alharahsheh & Pius, 2020). As Saunders et al. (2012) elucidate, the interpretivist approach necessitates researchers' engagement as social participants to comprehend the inherent diversity of human perspectives. In this investigation, such differences manifest distinctly among practicing teachers, whose varied cognitive frameworks, perceptual orientations, conceptual understandings, and experiential backgrounds collectively shape their professional practice.

Ontological Considerations

The ontological position of this study acknowledges reality as a socially constructed phenomenon (Cohen et al., 2018; Cao-Thanh & Le Thanh, 2015). This conceptualisation necessitates direct engagement with participants to access their multiple, subjectively constituted realities. Each teacher-participant articulates a unique ontological perspective, informed by their pedagogical beliefs, institutional context, and personal history with Cognitive Diagnostic Assessment (CDA). Accordingly, the research process fundamentally intertwines the researcher with participants, rejecting the possibility of detached observation.

Epistemological Position

The epistemological framework follows Cohen et al.'s (2018) conceptualisation of interpretivist knowledge acquisition. Rather than pursuing objective facts, knowledge emerges dialogically through in-depth exploration of teachers' lived experiences with CDA implementation. This approach prioritises the co-construction of meaning, whereby the researcher facilitates participants' articulation of their professional realities while simultaneously interpreting these accounts through theoretical lenses.

1.11.2 RESEARCH DESIGN

The research design constitutes the structural framework that governs participant selection, variable inclusion and manipulation, and the management of extraneous influences, thereby ensuring the research problem is systematically addressed (Dannels, 2018). This study adopted a phenomenological design, an approach specifically concerned with investigating lived experiences to develop a profound, nuanced understanding of how individuals interpret and derive meaning from those experiences (Idika, 2023).

Phenomenology was deemed the most appropriate methodological approach for this investigation, as it facilitates an in-depth exploration of participants' subjective realities. By focusing on the lived experiences of practicing teachers who have engaged with Cognitive Diagnostic Assessment (CDA), this study sought to uncover the essence of their encounters how they perceived, internalised, and responded to the implementation of CDA within their professional practice. The phenomenological approach prioritises the voices of those who have directly experienced the phenomenon, ensuring that the findings are grounded in authentic, contextually rich narratives rather than abstract theorisation.

This methodological choice aligns with the study's interpretivist paradigm, which emphasises the multiplicity of human understanding and the socially constructed nature of reality. By centring teachers' perspectives, the research design acknowledges that their experiences are not merely data points but meaningful, situated accounts that reveal the complexities of adopting innovative assessment practices in real-world educational settings.

1.11.3 RESEARCH APPROACH

This study employed a qualitative research approach, which is principally concerned with the examination and interpretation of non-numerical data, particularly where phenomena resist simple

quantification (Idika, 2023). The qualitative research approach was deemed eminently suitable for this investigation as it facilitates an in-depth exploration of practicing teachers' subjective experiences with Cognitive Diagnostic Assessment (CDA) implementation.

The adoption of this approach was predicated on several key considerations. Firstly, the research objectives necessitated the collection and analysis of rich, descriptive accounts rather than statistical data. Secondly, qualitative research methods are uniquely positioned to uncover the complex, nuanced realities of educational practice that quantitative measures often fail to capture. As the study sought to understand teachers' personal interpretations, challenges, and adaptive strategies regarding CDA use, a qualitative framework provided the necessary methodological flexibility to explore these lived experiences in their full contextual complexity.

Moreover, qualitative inquiry aligns with the study's phenomenological design, as both emphasise the importance of understanding phenomena from participants' own perspectives. This approach enabled the researcher to move beyond superficial accounts and develop a sophisticated, multi-faceted understanding of how teachers conceptualise and operationalise CDA in their daily practice. The depth of insight afforded by qualitative methods is particularly valuable when investigating under-researched areas such as CDA implementation in Lesotho's educational context.

By privileging teachers' voices and experiences, this qualitative approach ensures that the findings remain grounded in the realities of classroom practice while contributing to broader theoretical discussions about assessment innovation in developing educational systems.

1.11.4 METHODS OF DATA GENERATION

The study employed three principal instruments for data generation: in-depth interviews utilising semi-structured questions, classroom observations, and document review methods. As Rutledge and Hogg (2020) elucidate, in-depth interviews serve as a qualitative research instrument designed to facilitate comprehensive dialogues with a limited number of participants. This method enabled participants to articulate their experiences openly while maintaining focus on the study's research objectives.

In-depth interviews offer the significant advantage of enabling rich, nuanced exploration of stakeholders' lived experiences and perspectives (Lima et al., 2019), yet they simultaneously

present methodological challenges as interviewers must employ sophisticated techniques including careful management of verbal cues and body language to ensure data quality and participant comfort (Llagas, 2019).

Each interview session lasted approximately 45-60 minutes and was conducted face-to-face in conducive environments within school premises, facilitating both rapport establishment and the observation of meaningful non-verbal cues.

All interviews were audio-recorded following participants' informed consent and subsequently transcribed verbatim to ensure textual fidelity. Where necessary, member-checking procedures were employed to verify interpretive accuracy. The semi-structured interview guides were meticulously crafted to align with each research objective while retaining sufficient flexibility to accommodate unanticipated yet valuable participant perspectives.

Classroom observation

Observation serves as a critical research instrument that enables investigators to gather real-time data through systematic perceptual engagement with the phenomena under study (Satapathy, 2023). This method enhances the reliability and validity of research findings by providing first-hand, contextual evidence of observable behaviours and interactions.

The present study incorporated structured classroom observations as a complementary methodological approach to interview data, specifically designed to investigate four critical dimensions of pedagogical practice: (1) the practical implementation of assessment strategies within authentic classroom contexts; (2) teachers' diagnostic methodologies for evaluating student comprehension; (3) the qualitative characteristics and efficacy of feedback mechanisms; and (4) subsequent instructional modifications informed by assessment data analysis. This observational protocol facilitated the collection of empirical evidence regarding the enactment of theoretical assessment principles in real-world educational settings, thereby enabling triangulation with self-reported interview data and providing a more holistic understanding of teachers' assessment practices.

The observational protocol focused particularly on the dynamic interplay between assessment practices and pedagogical decision-making, capturing the nuanced ways in which teachers operationalised Cognitive Diagnostic Assessment principles in their daily practice. By triangulating observational data with interview responses, the study achieved a more

comprehensive understanding of both the espoused and enacted dimensions of assessment innovation.

Document review

Where accessible, the study incorporated systematic review of three key documentary sources: lesson plans, assessment tasks, and student work samples. These materials served as vital evidentiary sources, providing contextual verification of the assessment strategies teachers employed in practice. The documentary analysis enabled triangulation with data derived from interviews and classroom observations, thereby enhancing the study's methodological rigour through multiple sources of evidence. This approach facilitated a more comprehensive understanding of both the planned and enacted aspects of teachers' assessment practices, while offering tangible examples of how assessment strategies translated into classroom implementation and student outcomes.

1.11.5 DATA ANALYSIS

This study employed an inductive thematic analysis, following the methodological framework established by Clarke and Braun (2006, 2009). As Clarke and Braun (2017) elucidate, this data-driven analytical method proves particularly valuable when investigating under-researched phenomena. The approach was ideally suited to this investigation's focus on exploring teachers lived experiences with Cognitive Diagnostic Assessment (CDA) a relatively novel domain of inquiry. The inductive methodology permitted themes to emerge organically from the raw data through a systematic six-phase process: (1) data familiarisation, (2) initial code generation, (3) theme identification, (4) theme refinement, (5) theme definition, and (6) report production.

For the technical execution of this analysis, the study utilised ATLAS.ti (version 24.1.0), a sophisticated qualitative data analysis software package that enabled precise coding, efficient data retrieval, and visualisation of emerging thematic patterns.

Analysing data collected through observation

These data were analysed using inductive thematic analysis and ATLAS ti. The researcher used observation guide (appendix 6) to collect data. All six phases proposed by Clarke and Braun (2006,2009) were employed. The researcher read observation notes several times. Then initial

codes were generated by going through data line by line, highlighting interesting codes in ATLAS ti. Then reviewed all codes grouped related ones into themes, ensuring that each theme accurately reflects patterns across my data. Then I merged some themes in ATLAS ti. Then wrote clear definitions of each theme in ATLAS ti, added memos to those themes. Lastly, I supported each theme with the direct quotes.

Analysing data collected through in-depth interviews

The researcher listened to the audios several times. Then each response from the participants was transcribed and saved as word documents. Then generate codes. Codes were reviewed and related codes were grouped together. Then data were revisited, and themes were verified. Then the themes were defined.

Then ATLAS ti was used. Each word document was read several times and memos were used to record initial thoughts. ATLAS ti allows effective coding procedures, visual mapping of conceptual relationships between emerging codes, and systematic tracking of analytical memos throughout the interpretive process.

Analysing data collected through document review

The researcher followed similar procedure as when analysing in-depth interviews and observation. Lesson plans were read several times. Emerging patterns were noted.

1.12 TRUSTWORTHINESS IN RESEARCH

Trustworthiness in qualitative research denotes the methodological rigour and substantive quality of the investigation. This study implemented robust measures to ensure the findings remained credible, meaningful, and authentically reflective of participants' lived experiences through four key dimensions:

Transferability (Kakar et al., 2023): Achieved through comprehensive, thick descriptions of the research context, participant profiles, and methodological processes, enabling readers to evaluate potential applicability to comparable settings.

In this study thick, rich descriptions of the research context were provided, encompassing detailed accounts of the geographical locations, socio-economic environments, and institutional infrastructures characterising both the Maseru and Botha-Bothe districts; participant profiles were

meticulously documented, including relevant professional characteristics such as years of teaching experience, subject specialisations, and prior engagement with Cognitive Diagnostic Assessment (CDA) methodologies; and comprehensive procedural accounts were furnished regarding the study's implementation, thereby equipping readers with the necessary contextual and methodological information to make informed judgements about the potential applicability of the findings to their own educational settings.

Confirmability (Kocaman, 2024): Maintained through:

Systematic researcher reflexivity via maintained reflective journals documenting personal influences

Evidence-based interpretations substantiated by direct participant quotations and multi-source data verification

In this study confirmability was verified through the following; researcher reflexivity was maintained through systematic journaling to document and critically examine my own assumptions, methodological decisions, emotional responses, and potential biases throughout the research process; peer debriefing was conducted with an experienced qualitative researcher who independently reviewed my analytical interpretations, coding frameworks, and emergent themes to verify their grounding in the empirical data; and all substantive analytical claims were substantiated through direct evidentiary support from participant quotations and methodological triangulation across interviews, observations, and documentary sources, thereby ensuring the findings remained firmly anchored in the collected data rather than subjective interpretation.

Dependability (Polit & Black, 2021): Ensured through:

-Meticulous **audit trails** documenting all methodological decisions and procedural rationales

-Structured **peer debriefing** sessions with academic colleagues to scrutinise analytical processes

In this study, comprehensive audit trails were meticulously maintained, comprising exhaustive documentation of all methodological procedures, data collection protocols, analytical frameworks, and thematic development processes to ensure complete transparency; peer debriefing sessions were conducted with academic colleagues and supervisory panels, who critically examined the analytical progression and interpretive decisions to verify methodological rigour and minimise subjective bias; and systematic recording of all procedural adaptations and analytical judgements

was implemented, thereby establishing a replicable research architecture that facilitates future scholarly examination of comparable phenomena while maintaining rigorous standards of methodological transparency.

Credibility (Lincoln & Guba, 1985, cited in Abidin et al., 2024): Established via:

-**Member checking** procedures where participants validated transcript accuracy and preliminary findings

-Methodological **triangulation** combining interview data, classroom observations, and document analysis

Prolonged field engagement to develop contextual understanding and participant rapport

This multi-faceted approach systematically addressed potential validity threats while strengthening the study's empirical grounding in participants' authentic perspectives.

In this study, member checking was systematically implemented following Birt et al.'s (2016) protocols, whereby participants actively verified both their interview transcripts and preliminary analytical interpretations through an iterative process that ensured the faithful representation of their intended meanings and experiential accounts; secondly, methodological triangulation was rigorously applied, with emerging patterns cross-validated through multiple evidentiary streams - including semi-structured interviews, naturalistic classroom observations, and comprehensive document analysis - thereby mitigating the limitations inherent in single-source data while substantiating the robustness of thematic findings (Tariq, 2025); thirdly, prolonged engagement was strategically maintained across all research sites, facilitating both the development of meaningful rapport with participants and the acquisition of nuanced, contextually-grounded insights into the complex interplay between institutional environments, pedagogical practices, and teachers' evolving engagement with Cognitive Diagnostic Assessment (CDA) methodologies.

1.13 ETHICAL CONSIDERATION ON DATA COLLECTION

Ethical considerations constitute a fundamental aspect of qualitative research, particularly when involving participants' personal information. This study adhered to the following ethical protocols:

1. Formal approval was obtained through an introductory letter granted by the Dean of the Faculty of Education (National University of Lesotho).
2. Written permission was secured from school principals prior to conducting teacher interviews.
3. All participants received comprehensive information regarding the study's purpose, with written informed consent obtained prior to data collection.
4. Participants were assured that any information they provide will be kept confidential and they will remain anonymous throughout data generation and analysis.
5. Participants were explicitly assured of voluntary involvement, with the right to withdraw from the study at any stage without consequence.

1.14 DISSERTATION OUTLINE

Chapter One presents the study's contextual background, problem statement, research objectives and questions, alongside the significance and scope of the investigation.

Chapter Two establishes the theoretical framework, examining both conceptual and empirical literature relevant to the research focus.

Chapter Three details the methodological approach, encompassing the research paradigm, design, and data generation instruments

Chapter Four details the presented of generated data and analysis of data

Chapter Five provides an in-depth discussion of the results in relation to existing scholarship.

Chapter Six synthesises key findings, discusses theoretical and practical implications, acknowledges study limitations, and suggests directions for future research.

1.15 Conclusion

This study seeks to investigate practising teachers' experiential engagement with cognitive diagnostic assessment (CDA) methodologies within authentic classroom contexts. The present chapter has established the scholarly background, articulated the research problem, and delineated the study's principal objectives. Furthermore, it has formulated the guiding research question while explicating the investigation's academic significance and methodological parameters. The subsequent chapter will undertake a comprehensive review of pertinent theoretical and empirical literature to situate this inquiry within existing scholarly discourse.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

The literature review for this chapter is structured into the following sections: the theoretical background, conceptual review, empirical review, and an appraisal of the literature, including the identification of gaps. The theoretical background examines Social Cognitive Theory (SCT), which forms the foundational framework for this study. SCT offers a robust lens through which to analyse human behaviour within social contexts, particularly in terms of knowledge acquisition and skill development. This theoretical perspective provides critical insights into how teachers in Lesotho might effectively integrate Cognitive Diagnostic Assessment (CDA) into their pedagogical practices. Subsequently, the conceptual review delineates key constructs and operational definitions pertinent to CDA, while the empirical review synthesises existing studies on teachers' experiences with CDA implementation, drawing on relevant international and regional evidence. Finally, the chapter concludes with a critical appraisal of the literature, evaluating strengths, limitations, and unresolved debates, thereby elucidating the research gap that this study seeks to address.

2.1 THEORETICAL BACKGROUND

Theoretical Framework: Social Cognitive Theory (SCT)

This study is underpinned by Social Cognitive Theory (SCT) (Bandura, 1986), which seeks to elucidate how individuals acquire knowledge, beliefs, attitudes, and cognitive processes within their social environments. SCT posits that individuals are active agents who both shape and are shaped by their surroundings. The theory emphasises human agency in modifying personal traits, behaviours, and competencies such as skills through social engagement. Central to SCT is the notion that learning is an inherently social process, characterised by a triadic reciprocal interaction between the individual, their environment, and their behaviour (Bandura, 1986). Learning, as a cognitive phenomenon, is inextricably linked to its context, whether familial, educational, or societal (Kauffman, Fuente, & Boruchovitch, 2023).

Bandura's theory asserts that learning occurs not only through direct experience but also via observational learning, wherein individuals assimilate knowledge by observing others and the consequences of their actions. SCT thus serves as a valuable framework for predicting and modifying human behaviour (Green & Peil, 2009). The key constructs of SCT include:

Self-Efficacy

Self-efficacy refers to an individual's conviction in their ability to execute tasks successfully (Channawar, 2023). Bandura (1977) defines it as a person's confidence in their capacity to exert control over their actions. This construct influences behaviour, decision-making, adaptability, resilience, and goal attainment. Self-efficacy varies in magnitude, strength, and generality (Bandura, 1989). For instance, when teachers are required to adopt complex assessment methodologies, fluctuations in self-efficacy may occur. Those with high self-efficacy perceive challenges as opportunities for mastery, whereas those with low self-efficacy may avoid challenges, focusing instead on perceived inadequacies (Mark & Campbell, 2011). Teachers with robust self-efficacy are more likely to embrace innovative assessment strategies, facilitating comprehensive student progress evaluation (Beauchamp, Crawford, & Jackson, 2018).

Observational Learning

Observational learning necessitates attention, retention, reproduction, and motivation (Bandura, 1986). Individuals learn by observing models, but distractions may impede this process. Successful observational learning depends on the ability to retain and replicate observed behaviours.

Modelling and Reinforcement

SCT posits that learning is further facilitated through modelling and reinforcement. A model must be present for observers to emulate, while reinforcements whether positive or negative shape behavioural persistence (Devi et al., 2022). These reinforcements may be intrinsic (for example personal satisfaction) or extrinsic (for example professional recognition).

Reciprocal Determinism

Bandura (1978) conceptualises reciprocal determinism as the dynamic interplay between personal factors (such as cognition, affect), behaviour, and environmental influences. This bidirectional relationship underscores that individuals are both products and architects of their social worlds.

Application of SCT to the Study

SCT provides a robust theoretical lens through which to examine how practicing teachers in Lesotho perceive, adopt, and utilise Cognitive Diagnostic Assessment (CDA). The theory's emphasis on observational learning, self-efficacy, modelling, and reciprocal determinism elucidates the mechanisms shaping teachers' experiences with CDA.

Observational Learning: Teachers may acquire CDA implementation strategies by observing peers or educational experts in workshops.

Self-Efficacy: Teachers with high self-efficacy are more likely to experiment with CDA, whereas those with low self-efficacy may resist change, fostering negative attitudes.

Modelling & Reinforcement: Effective CDA practices can be modelled after educational leaders or colleagues. Positive reinforcement (for example recognition, rewards) may sustain CDA adoption.

Reciprocal Determinism: Teachers' use of CDA is influenced by contextual factors, such as school culture, administrative support, and resource availability. Conversely, their implementation of CDA may alter classroom dynamics and student outcomes.

Contribution to Research Questions

Social Cognitive Theory (SCT) provides a robust theoretical framework for examining the study's research questions, offering insights into the cognitive, behavioural, and environmental factors that influence teachers' engagement with Cognitive Diagnostic Assessment (CDA). Bandura's (1986) SCT elucidates how observational learning, self-efficacy, modelling, and reciprocal determinism shape teachers' experiences, perceptions, and challenges in adopting CDA. Furthermore, the theory yields practical implications for fostering effective CDA implementation in Lesotho's educational context.

Analysis of Research Questions Through an SCT Lens

First, SCT aids in understanding teachers' experiences with CDA implementation, which are significantly influenced by observational learning and self-efficacy. Teachers acquire knowledge

of CDA not only through formal training but also by observing peers and educational specialists. Those with high self-efficacy are more likely to experiment with new assessment methods, whereas those with low self-efficacy may resist change due to apprehensions about their competence (Bandura, 1989). Thus, SCT helps explain variations in teachers' willingness and ability to integrate CDA into their pedagogical practices.

Second, SCT informs the analysis of teachers' perceptions of CDA's effectiveness, which are mediated by self-efficacy and social modelling. Teachers who observe successful CDA implementation by colleagues or receive positive reinforcement such as recognition or improved student outcomes are more likely to perceive CDA as a valuable tool. Conversely, those who lack confidence in their assessment skills or work in unsupportive environments may view CDA as impractical or burdensome.

Third, SCT provides a framework for examining the challenges in CDA integration, particularly through the lens of reciprocal determinism. Environmental constraints such as limited resources, inadequate training, or unsupportive school policies may hinder CDA adoption. However, SCT posits that teachers can mitigate these challenges through peer collaboration, where experienced colleagues model effective practices, thereby fostering a culture of shared learning and problem-solving.

Practical Implications for CDA Adoption

Beyond theoretical contributions, SCT suggests actionable strategies to facilitate CDA implementation:

Professional Development to Enhance Self-Efficacy

Targeted training programmes should not only familiarise teachers with CDA techniques but also strengthen their confidence in applying them. Workshops that incorporate hands-on practice and constructive feedback can bolster self-efficacy, encouraging teachers to adopt innovative assessment methods.

Peer Modelling and Observational Learning Opportunities

Schools should promote collaborative learning environments where teachers can observe and emulate colleagues who successfully use CDA. Demonstration lessons, peer observations, and communities of practice can serve as effective platforms for observational learning.

Cultivating Supportive School Environments

Institutional leadership plays a crucial role in incentivising CDA adoption. School administrators should provide necessary resources, recognise effective implementation, and foster a culture that values assessment innovation. Positive reinforcement such as professional recognition or tangible rewards can sustain motivation for CDA use. By integrating SCT, this study advances a nuanced understanding of the dynamic interplay between individual cognition, behaviour, and environmental factors in CDA implementation. The theory not only elucidates the mechanisms shaping teachers' experiences and perceptions but also offers evidence-based strategies to support CDA adoption in Lesotho's classrooms. Ultimately, applying SCT enhances both the theoretical and practical dimensions of this research, contributing to more effective assessment practices in education.

Towards an Africanised CDA Framework for Lesotho

While Cognitive Diagnostic Assessment (CDA) originates from psychometric traditions in the Global north, its adaptation to African contexts requires a deliberate integration of local realities, pedagogical traditions, and education policy priorities. In particular, CDA in Lesotho must be aligned with the Lesotho Basic Education Curriculum and Assessment Policy (LEBCP,2009; revised 2021), which emphasizes formative assessment, inclusivity, and problem -solving skills. An Africanised CDA framework, therefore, extends beyond cognitive profiling to incorporate social, linguistic, and cultural dimensions that shape learners' educational journeys.

First, the framework emphasis holistic learner profiling. Unlike conventional CDA, which often limits itself to discrete cognitive skills, an Africanised version acknowledges the role of language diversity, social-economic background, and community values in shaping learning outcomes. For example, diagnostic information in multilingual Lesotho classrooms must capture not only mastery of subject content but also how the language of instruction (English) intersects with learning barriers.

Second, the framework integrates context-responsive pedagogy. In African classrooms, where overcrowding and limited resources are common, CDA must be embedded into low-tech and teacher-friendly practices such as oral questioning, peer -learning groups, and observation-based checklists. This moves diagnostic assessment from being dependent on advanced psychometric software to being practical and sustainable in under-resourced environments (Matore & Noh,2023).

Third, the framework positions CDA as a tool for African problem-solving skills. Echoing the African Renaissance version (Mbele,2021), assessment must cultivate learners who can critically apply knowledge to solve local challenges such as food insecurity, climate resilience, and public health. An Africanised CDA thus diagnoses not only whether learners can recall knowledge, but whether they can transfer it to real-life, community-based problem contexts.

Finally, the framework underscores collaborative teacher agency. Teachers are not passive implementers of externally designed diagnostic tools but active co-creators of assessment practices. Through professional learning communities, peer observations, and shared toolkits, teachers collectively refine CDA to reflect their learners' needs and Lesotho's educational vision. This proposed framework Africanised CDA framework contributes to assessment theory by grounding CDA in African epistemologies of education, which value relationality, communal learning, and contextual problem-solving. It also provides a practical pathway for policy-makers and practitioners in Lesotho to implement diagnostic assessments that are both globally informed and locally relevant.

Africanised CDA Framework: Four Pillars

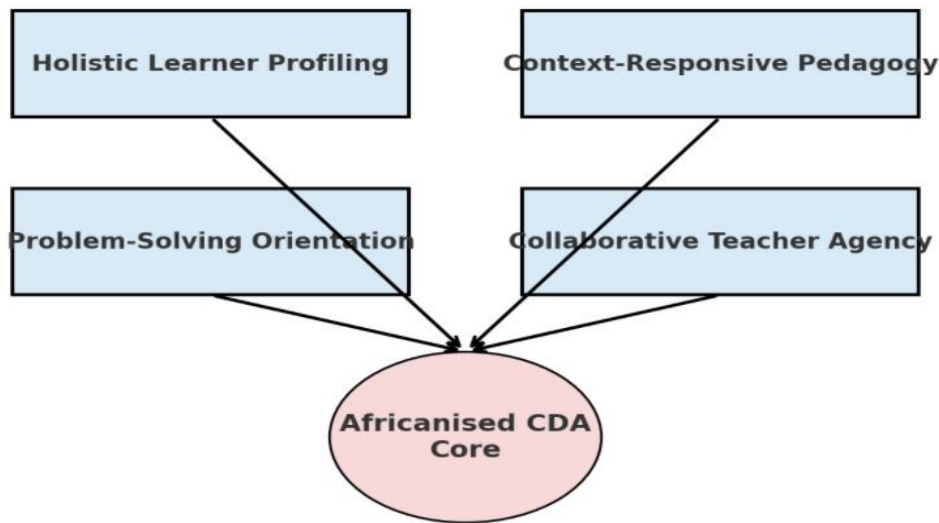


Figure 2.1 proposed Africanised CDA framework model.

Theoretical underpinnings of CDA in the African context

While Cognitive Diagnostic Assessment (CDA) is primarily rooted in psychometric theories and cognitive psychology (Rupp, Templin & Henson, 2010), its application must be re-examined within the African context. African scholars argue that educational theories must move beyond reproducing Euro-American paradigms to incorporate indigenous perspectives and problem solving approaches that are relevant to the continent's unique social, cultural and economic challenges (Hoppers,2019;Letseka,2022).The African Renaissance philosophy, for instance,emphasises education as a tool for self-reliance and community empowerment (Mbele,2021).In this regard,CDA aligns with African priorities by providing diagnostic insights that allow teachers to design responsive interventions, ensuring that learners develop not only cognitive mastery but also the problem-solving skills needed to tackle challenges in their communities.

Relevance of CDA to Lesotho

The relevance of CDA to Lesotho lies in the complementarity with the Lesotho Basic Education Curriculum and Assessment Policy (LBECAP,2009; revised 2021), which emphasises learner-centered ,formative, and inclusive assessment practices. Traditional assessments in Lesotho have historically privileged rote memorisation, offering limited diagnostic feedback (World Bank ,2009).CDA, by contrast, provides granular insights into learners' strengths and weaknesses, equipping teachers with the capacity to tailor remediation and enrichment. For example, multilingual classrooms where learners often struggle with English as the language of instruction can identify specific gaps in vocabulary or comprehension, allowing teachers to design targeted support. This resonates with African assessment models such as Continuous Assessment (CASS) widely adopted in West and Southern Africa, which also aim to provide ongoing feedback to support learner development (Akyeampong ,2017).

Validation of CDA

Globally, CDA has been validated in multiple contexts across mathematics, science and language learning (Shi et al., 2024;Peng et al.,2023).Its core premise -that diagnostic feedback improves instructional responsiveness is consistent with formative assessment theories advanced by Black and William (2009).In African contexts, while large-scale psychometric validation is still limited, pilot projects in countries such as South Africa and Kenya demonstrate that diagnostic assessment tools can be adapted successfully to resource-constrained environments

(Moloi,2019;Komba,2020).In Lesotho, the pilot implementation of CDA through short teacher training programmes and classroom experimentation has provided preliminary evidence of its utility, though systematic scaling remains necessary.

Moving Beyond Cognitive Reproduction

One criticism of CDA,raised in global debates, is that it may still privilege cognitive skill mastery over broader competences such as creativity and socio-emotional learning (Monarrezzo & Tchoshanou,2020).However, African education systems grappling with issues of unemployment, poverty, and social inequality require assessment models that cultivate learners' ability to solve real-world problems in locally meaningful ways (Letseka,2022).When adapted thoughtfully has the potential to serve this purpose; by moving teachers beyond test scores to diagnose conceptual misunderstandings, foster critical thinking, and provide equitable opportunities for learners with diverse abilities.

2.2 CONCEPTUAL REVIEW

This section examines the foundational concepts underpinning the study, focusing on three key areas that inform our understanding of Cognitive Diagnostic Assessment (CDA) implementation in Lesotho's educational context. First, we consider the structure and organisation of Lesotho's educational system, analysing its unique characteristics that may influence assessment practices. The review explores how the system's historical development, policy framework, and current operational structures create both opportunities and constraints for implementing innovative assessment approaches like CDA.

Second, the concept of assessment in education is critically examined. This includes an analysis of assessment's pedagogical purposes, from formative to summative applications, and how these relate to diagnostic assessment models. Particular attention is given to the theoretical distinctions between traditional assessment methods and the more nuanced approach offered by CDA.

Finally, the review investigates teachers' perceptions and beliefs regarding assessment effectiveness. This conceptual exploration considers how teacher attitudes towards CDA may be shaped by professional experience, training background, and the practical realities of classroom implementation. The section establishes how these perceptions potentially mediate the adoption and successful application of diagnostic assessment methods.

Through this conceptual triangulation, the review establishes a theoretical framework that connects systemic educational structures, assessment theory, and practitioner perspectives which are the three critical dimensions for understanding CDA implementation in the Lesotho context.

This concise yet comprehensive conceptual foundation enables subsequent examination of how these elements interact in practice, as explored in the empirical review that follows. The conceptual clarity established here proves particularly valuable when analysing potential gaps between assessment theory and classroom reality in Lesotho's schools.

2.2.1 EDUCATIONAL SYSTEM OF LESOTHO

Lesotho has undergone significant educational reforms aimed at enhancing the quality of education and equipping Basotho children with the necessary knowledge and skills for personal and national development. As Raselimo and Mahao (2015) assert, these reforms have been driven by the need to align education with broader developmental goals. However, concerns have been raised regarding the efficacy of these reforms, with Chere-Masopha and Mothiba (2022) arguing that the Ministry of Education and Training (MOET) has historically provided an education that fails to adequately prepare students for functional and productive participation in their communities or the global arena. Chere-Masopha and Mothiba (2022) noted that the public was dissatisfied with the methods of teaching, learning, and assessment in Lesotho's classrooms. The assessments in place failed to evaluate the practical skills required in the job market (MOET, 2009). Additionally, Raselimo and Mahao pointed out that there was inadequate localization, which resulted in content that did not meet the needs of society.

In response to the shortcomings mentioned above, the Curriculum and Assessment Policy (CAP) was introduced in 2009, marking a pivotal shift in Lesotho's educational framework. This policy sought to integrate curriculum and assessment more closely, with the dual objectives of measuring competencies aligned with curricular goals and providing meaningful feedback to stakeholders. A notable feature of CAP 2009 was its restructuring of the education system into basic education (Grades 1-10) and secondary education (Grades 11-12), accompanied by the phasing out of traditional examinations such as the Cambridge Overseas School Certificate (COSC), Junior Certificate (JC), and Primary School Leaving Examination (PSLE), which were replaced with national examinations and the Lesotho General Certificate of Secondary Education (LGCSE).

Despite these ambitious reforms, CAP 2009 encountered substantial implementation challenges. Moea (2021) identified critical issues including insufficient resources, inadequate teacher training,

disparities in educational access, and linguistic diversity. Teachers faced particular difficulties with the introduction of portfolios, while systemic problems such as the absence of textbooks, disorganised syllabi, and compressed teaching timelines further undermined the policy's effectiveness (Chere-Masopha & Mothiba, 2022). These challenges necessitated further reform, culminating in the Lesotho Basic Education Curriculum Policy (LBECP) of 2021, which reorganised the education system into Early Childhood Care and Development (ECCD), primary, secondary, and tertiary/vocational education streams.

The current structure of Lesotho's education system reflects a commitment to progressive educational principles. The ECCD programme, catering to children aged 0-4 years, adopts a play-based approach that acknowledges developmental differences and emphasises smooth transitions between educational stages. Primary education, comprising foundation (Grades R-3) and intermediate (Grades 4-7) phases, is designed to be free and compulsory, building progressively on learners' knowledge and skills. Secondary education (Grades 8-12) offers both academic and vocational pathways, aligning with Lesotho's commitment to Sustainable Development Goal 4 (SDG-4) on inclusive, quality education.

Nevertheless, the system continues to face significant challenges that hinder its ability to deliver quality education consistently. Resource limitations, encompassing physical, digital, human, and financial dimensions, remain pervasive (Kurata et al., 2022; Bukola et al., 2025). Schools frequently lack basic infrastructure such as textbooks, laboratories, and digital technologies, with rural areas particularly disadvantaged (Rakolobe, 2024; Rakolobe & Teise, 2024). The integration of technology, while emphasised in LBECP 2021 as essential for 21st-century skills development, is hampered by poor connectivity and inadequate equipment (Nkhi & Mofana, 2024; Selialia et al., 2023).

Linguistic diversity presents another complex challenge. Although the Lesotho Education Language Policy (2019) advocates for mother-tongue instruction in early grades and the inclusion of minority languages, implementation has been inconsistent. Many learners from minority language communities continue to be taught in Sesotho rather than their mother tongues, potentially hindering comprehension and academic performance (Kolobe & Matsoso, 2024). This situation mirrors challenges observed in other African contexts, where shortages of teachers trained in mother-tongue methodologies and lack of appropriate teaching materials have constrained similar policies (Mandillah, 2019; Gaspar, 2023).

Geographical and socioeconomic disparities further exacerbate inequalities in educational access and quality. Rural schools consistently report greater resource deficiencies compared to their urban counterparts, while the divide between private and public institutions creates additional stratification in educational experiences (Lian, 2024). These disparities underscore the persistent tension between policy aspirations and implementation realities in Lesotho's education system.

While Lesotho's educational reforms demonstrate a clear commitment to improving quality and accessibility, systemic challenges continue to impede their full realisation. Addressing these issues particularly resource allocation, teacher training, linguistic inclusion, and geographic equity remains critical for achieving the transformative potential of Lesotho's education policies and meeting both national developmental goals and international commitments to inclusive, quality education.

2.2.2 ASSESSMENT IN EDUCATION

Assessment has traditionally served as a mechanism for estimating student achievement and assigning grades (Seipel et al., 2018). However, contemporary perspectives, as articulated by Brown (2022), challenge this narrow conceptualisation, arguing that assessment constitutes more than merely allocating scores to tasks or questions. Rather, it represents a systematic endeavour to sample and evaluate specific constructs or content domains within an educational framework.

Mothetsi-Mothiba (2019) defines assessment as a continuous process involving the collection, analysis, and reflective interpretation of data pertaining to teaching and learning. This conceptualisation aligns with Prijowuntato's (2021) view that assessment serves as an indicator of student success in educational activities, requiring teachers to gather, interpret, and evaluate evidence of learning. The significance of educational assessment extends beyond individual student evaluation, playing a pivotal role in shaping the quality of learning experiences, informing instructional practices, and facilitating curriculum and systemic evaluation (Brown, 2022; Yul et al., 2022). As a cornerstone of educational quality, assessment not only engages learners actively in the educational process (Akmalia et al., 2023) but also serves as a crucial tool for decision-making regarding student progress and instructional improvement (Sari & Setiawan, 2020). Yambi (2018) emphasises the critical importance of well-designed assessment strategies in informing decisions at both pedagogical and curricular levels, while Sumardi (2020) highlights the essential role of assessment-derived feedback in monitoring student outcomes and evaluating the effectiveness of teaching objectives.

Assessment manifests in two primary forms: formative and summative. Formative assessment, as described by Melani (2022), represents an ongoing evaluation of student knowledge during the learning process, enabling teachers to monitor progress and adjust instruction accordingly. Pramestic (2024) elaborates on its diagnostic function, allowing educators to identify areas of student strength and weakness while adapting teaching strategies to meet diverse classroom needs. The Ministry of Education and Training (MOET, 2009) categorises formative assessment as encompassing both diagnostic and continuous assessment components, with diagnostic assessment specifically designed to evaluate student readiness for learning (Shihab, 2022) and establish baseline competencies (Nasution, 2021).

Within this context, Cognitive Diagnostic Assessment (CDA) has emerged as a significant development in educational assessment. Javidanmehr et al. (2017) attribute the growing interest in CDA to the limitations of traditional assessments in providing detailed diagnostic feedback. Unlike conventional approaches, CDA offers teachers precise, granular insights into learners' mastery of specific sub-skills within cognitive domains. For instance, in assessing reading comprehension, CDA can identify discrete competencies such as vocabulary knowledge and grammatical understanding, providing a more nuanced picture of student learning than traditional assessment methods. This diagnostic capability positions CDA as a valuable tool for addressing individual learning needs and enhancing instructional precision in contemporary educational practice.

The evolution from traditional assessment paradigms to more sophisticated approaches like CDA reflects a broader shift in educational philosophy, where assessment is increasingly viewed not merely as an endpoint of learning but as an integral, dynamic component of the teaching and learning process. This transition underscores the growing recognition of assessment's multifaceted role in supporting student learning, informing instructional practice, and ultimately enhancing educational outcomes.

2.2.3 Cognitive Diagnostic Assessment (CDA)

Within an instructional setting, when teachers aim to identify students mastered and underdeveloped cognitive skills, they must design targeted assessment tasks to evaluate each discrete competency. A student's incorrect response to such a task reveals specific skill deficiencies, whereas a correct response demonstrates established proficiency. This diagnostic approach enables precise identification of learning gaps and informs subsequent pedagogical interventions.

For example, in a Mathematics class, a teacher might assess multiplication and division skills using the following tasks:

a) $6 \times 2 = ?$ A response of 12 shows the student can multiply.

b) $6 \div 2 = ?$ A response of 2 indicates the student can divide.

c) $6 \times 12 \div 3 = ?$

The application of the BODMAS rule in mathematical problem-solving serves as an instructive example of how targeted assessment tasks can reveal specific cognitive competencies. When a student correctly solves an equation requiring division before multiplication, arriving at the solution of 24, this demonstrates mastery of both operational sequencing and arithmetic execution. Cognitive Diagnostic Assessment (CDA) emerges as a sophisticated methodological framework designed to systematically identify such acquired and deficient skills within learners' cognitive architectures.

As Chin et al. (2021) elucidate, CDA represents a transformative approach to educational assessment, providing granular insights into students' cognitive processes and knowledge structures. This methodology enables precise evaluation of learners' ability levels and subject mastery (Wang et al., 2024), moving beyond mere performance metrics to uncover the underlying cognitive dimensions of learning. The diagnostic power of CDA, as articulated by Cui (2012), manifests in its capacity to deliver detailed feedback about students' domain-specific knowledge and skills, thereby facilitating the development of targeted pedagogical interventions.

The utility of CDA extends across the instructional continuum, serving both formative and summative purposes. As Anisah and Amreta (2024) illustrate, teachers may deploy CDA at various instructional junctures whether at the commencement of learning to establish baseline competencies or at its conclusion to evaluate skill acquisition. This diagnostic functionality provides teachers with a robust framework for formative assessment (Zhan & Tang, 2021), enabling continuous monitoring of student progress and timely identification of unmastered cognitive skills.

CDA's distinctive value becomes particularly apparent when contrasted with traditional assessment paradigms. Whereas conventional methods typically reduce student performance to

singular numerical scores (Maas et al., 2022), CDA offers multidimensional diagnostic information (Fan, 2021). Traditional approaches, as Williamson (2023) critiques, often fail to communicate meaningful information about learners' specific competencies, instead prioritising comparative performance metrics. CDA addresses this limitation by deconstructing test performance into constituent cognitive processes and strategies (Wang et al., 2024; Zhang et al., 2020).

The theoretical foundations of CDA derive from empirically validated cognitive diagnostic models (Fan et al., 2021) that acknowledge the complex, multifaceted nature of problem-solving. Globally, CDA has been validated in multiple contexts across mathematics, science and language learning (Shi et al., 2024; Peng et al., 2023). As Zhang, Jang and Chahine (2020) demonstrate, CDA illuminates the specific strategies learners employ when approaching academic tasks, thereby enabling teachers to identify and remediate ineffective problem-solving approaches. This stands in stark contrast to traditional assessments which, as Wang et al. (2024) observe, may yield identical scores for students with markedly different knowledge structures and skill profiles.

The pedagogical implications of CDA are profound. By providing detailed diagnostic information about students' cognitive strengths and weaknesses, CDA empowers teachers to develop precisely targeted instructional strategies (Paulsen & Sventina, 2021). This diagnostic precision facilitates the creation of personalised learning plans that address individual competency gaps, ultimately enhancing educational outcomes. As He, Jiang and Min (2021) emphasise, such diagnostic feedback serves as a crucial bridge between students' current performance levels and desired learning outcomes, transforming assessment from a mere measurement tool into a powerful instrument for educational improvement.

In mathematics education particularly, CDA's focus on problem-solving processes (Cui, 2012) aligns perfectly with the discipline's emphasis on procedural and conceptual understanding. The methodology's capacity to reveal the cognitive strategies underlying mathematical problem-solving represents a significant advancement over traditional assessment approaches that merely evaluate end products without illuminating the reasoning processes that generated them. This paradigm shift in assessment philosophy holds considerable promise for enhancing both instructional practice and student learning across academic disciplines.

2.2.3.1 Teachers' beliefs about the effectiveness of CDA for improving student learning.

Academic discourse reveals significant variation in teachers' perceptions regarding the pedagogical effectiveness of Cognitive Diagnostic Assessment (CDA). Empirical research conducted in Indonesia by Silvia et al. (2024) demonstrated that teaching staff at Pamaroh 1 maintained strongly positive beliefs about CDA's capacity to enhance learning outcomes. Their findings indicated that implementation of CDA correlated with improved student achievement and fostered more responsive instructional environments. The study particularly highlighted how the granular feedback generated through CDA facilitated more targeted teacher-student interactions and enabled the customisation of pedagogical approaches to address individual learning needs, thereby creating optimal conditions for academic progress.

The comparative advantages of CDA over traditional assessment paradigms have been substantiated by Fan et al. (2021), whose research established that diagnostic approaches yield more instructionally meaningful data than conventional testing methods. Traditional assessments' preoccupation with aggregate scores fails to discriminate between learners who achieve identical results through different cognitive pathways, whereas CDA's focus on discrete competencies provides educators with specific, individualised insights. This analytical precision enables the design of more effective, learner-centric instructional strategies.

The relationship between teacher beliefs and CDA implementation efficacy constitutes a critical factor in determining educational outcomes. Wang (2023) postulates that the successful integration of diagnostic feedback into classroom practice mediates CDA's effectiveness, suggesting that professional development initiatives should prioritise building teachers' competency in interpreting and applying CDA data. This position is reinforced by Saudabayeva et al. (2014), who identify teachers' capacity to generate objective, individualised feedback as fundamental to shaping positive perceptions of CDA's utility.

Contemporary research by Noh et al. (2024) further substantiates the transformative potential of CDA's detailed feedback mechanisms, demonstrating their positive influence on teachers' assessment beliefs. The scholarly consensus emerging from these studies affirms that when educators develop competence in utilising CDA's diagnostic capabilities, they become better equipped to identify specific learning gaps and strengths, ultimately enhancing both instructional quality and student achievement (Saudabayeva et al., 2014). This body of evidence underscores the importance of sustained professional development to maximise the pedagogical benefits of cognitive diagnostic approaches in diverse educational contexts.

2.2.3.2 Teachers' perceptions of the usefulness of CDA for identifying students' learning needs and adapting instruction.

Teachers' perceptions of Cognitive Diagnostic Assessment (CDA) encompass their cognitive and affective responses to its implementation in classroom settings, shaping how they interpret and utilise this assessment approach. As Fan et al. (2021) demonstrate, these perceptions are fundamentally informed by teachers' underlying beliefs about the pedagogical value of diagnostic assessment. Research by Wang (2023) establishes that teachers predominantly view CDA as a powerful tool for enhancing learning outcomes, given its capacity to provide precise insights into individual students' cognitive strengths and weaknesses. This diagnostic precision enables teachers to design targeted instructional interventions that address specific learning gaps during formative stages, thereby preventing the entrenchment of misconceptions in learners' cognitive frameworks. Treagust's (2012) work highlights how traditional assessment methods often fail to identify this early stage learning deficiencies, resulting in the consolidation of erroneous knowledge structures that hinder subsequent conceptual development.

The literature reveals strong consensus regarding CDA's role in addressing learner diversity. Studies by Ekayati et al. (2023) and Alfageh et al. (2024) provide empirical evidence that teachers perceive CDA as essential for identifying heterogeneous learning needs and implementing differentiated instruction. This perspective facilitates advanced pedagogical practices, including the creation of strategic learning groups, delivery of nuanced feedback, and optimal allocation of instructional time. Li's (2022) research further supports these findings, showing how CDA enables personalised learning approaches that transcend the limitations of standardised instruction.

At the theoretical level, CDA is grounded in Cognitive Diagnostic Models (CDMs), which Paulsen and Sventina (2021) characterise as sophisticated psychometric frameworks generating actionable diagnostic feedback for instructional remediation. Following George and Robitzsch's (2015) conceptualisation, CDMs represent a specialised class of latent variable models that analyse response patterns to estimate skill mastery profiles. These models serve the dual function of identifying cognitive competencies at both population and individual levels (Wafa, 2019), thereby supporting targeted pedagogical interventions.

The taxonomy of CDMs comprises three principal classifications. Compensatory models, as delineated by de la Torre (2011, cited in Shapfipoor et al., 2021), operate on the principle of skill substitution, where mastery of certain attributes can compensate for deficiencies in others. Notable examples include the Noisy Input, Deterministic 'Or' Gate (NIDO), Compensatory Reparameterised Unified Model (C-RUM), Additive Cognitive Diagnostic Model (ACDM), and Deterministic Input, Noisy 'Or' Gate (DINO). Wang et al. (2024) illustrate DINO's application in basic arithmetic operations, demonstrating its utility in assessing fundamental conceptual understanding.

Non-compensatory models require comprehensive mastery of all specified skills for successful item completion (Hadi et al., 2025). Prominent examples include the Non-Compensatory Reparameterized Unified Model (NC-RUM), Noisy Input, Deterministic 'And' Gate (NIDA), and Deterministic Input, Noisy 'And' Gate (DINA). Wang et al. (2024) elucidate DINA's application in complex arithmetic operations requiring sequential skill application, where learners must demonstrate mastery of all component skills to achieve correct responses.

General models represent hybrid frameworks accommodating both compensatory and non-compensatory relationships (Hadi et al., 2025). This category includes the Log-Linear Cognitive Diagnostic Model (LCDM), Generalized Deterministic Input, Noisy 'And' Gate Model (G-DINA), and General Diagnostic Model (GDM). Li et al. (2021) emphasise that GDM accounts for differential skill contribution weights, providing nuanced probabilistic estimates of item response accuracy based on partial skill mastery.

The theoretical significance of CDMs in educational assessment is multifaceted. As Wang (2023) and Saso et al. (2024) establish, these models provide comprehensive skill mastery diagnostics at population and individual levels, robust frameworks for learner clustering based on cognitive proficiency, empirical foundations for differentiated instructional planning, and mechanisms for longitudinal tracking of cognitive development. While acknowledging the existence of over sixty documented CDM variants (Li et al., 2021), this analysis focuses on models demonstrating particular relevance to classroom assessment practices in mainstream educational contexts. This selective approach aligns with the study's objective of identifying practically implementable diagnostic frameworks for primary and secondary education settings, contributing to the ongoing discourse on assessment-informed pedagogy.

2.4 EMPIRICAL LITERATURE

The persistent pursuit of robust assessment methodologies that transcend mere identification of learning difficulties to provide comprehensive diagnostic feedback has long preoccupied educational researchers. Conventional assessment approaches have proven inadequate in delivering the nuanced insights required for meaningful pedagogical intervention, whereas understanding the cognitive foundations of student struggles enables teachers to implement targeted instructional strategies (Cui et al., 2006). This epistemological shift precipitated the emergence of Cognitive Diagnostic Assessment (CDA) in the mid-1980s (Noh & Matore, 2024), representing a seminal convergence of cognitive psychology and psychometric theory (Butterfield et al., 1985). As Javidanmehr et al. (2017) elucidate, while cognitive psychology examines the mental architecture underlying human behaviour, psychometrics provides the quantitative framework for evaluating competencies, thereby establishing the theoretical foundations for CDA. The conceptual development of CDA gained substantial momentum through Embretson's (1991) pioneering work on cognitively-grounded item development. By the late 1990s, the methodology expanded into language assessment through retrofitting techniques (Mirzaei et al., 2020) the application of Cognitive Diagnostic Models (CDMs) to conventional tests not originally designed for diagnostic purposes. This pragmatic approach has been operationalised in high-stakes evaluations including IELTS and ESL examinations, particularly when developing novel diagnostic instruments proves impractical. Contemporary applications now span diverse academic disciplines, with Mei and Chen (2022) documenting its successful implementation in mathematics, sciences, and language testing through sophisticated analytical models that yield granular, actionable diagnostic data.

Global Implementation and Contextual Challenges

Empirical research across international contexts reveals both the potential and limitations of CDA implementation. Mirzaei et al.'s (2020) Iranian study, employing the G-DINA model to retrofit IELTS reading assessments, demonstrated differential attribute mastery patterns between engineering and veterinary students, highlighting CDA's capacity to inform discipline-specific pedagogical interventions. Conversely, Emmanuel and Ekpo's (2021) Nigerian research identified systemic constraints, particularly large class sizes that impede the practical application of

personalised feedback a finding that underscores the importance of contextual adaptation in CDA implementation.

The development of cognitively validated assessments presents both opportunities and obstacles. Toprak and Cakir's (2021) large-scale Turkish study developed an L2 reading comprehension test using log-linear cognitive diagnosis modelling (LCDM), demonstrating how robust construct understanding coupled with CDA frameworks can yield fine-grained diagnostic information. Nevertheless, the researchers cautioned about persistent challenges in sourcing suitable assessment items, a concern amplified by Liu and Huggies' (2018) contention that retrofitting may inadequately capture target competencies when tests lack appropriate design foundations.

Teacher Perceptions as Critical Variables

Teacher receptivity emerges as a pivotal factor in CDA efficacy. Jimola and Ofudu's (2019) Nigerian study revealed concerning disparities, with many ESL teachers demonstrating limited understanding of diagnostic assessment purposes and harbouring negative attitudes towards classroom implementation. This contrasts markedly with Alfageh et al.'s (2024) findings regarding mathematics teachers' positive reception of adaptive diagnostic tools, suggesting that subject-specific cultures and professional development opportunities significantly influence implementation success. Such divergences underscore Wang's (2023) assertion that teacher capacity to meaningfully integrate diagnostic feedback fundamentally mediates CDA's educational impact.

Subject-Specific Applications and Persistent Challenges

Discipline-focused research illustrates CDA's versatile applications while revealing enduring implementation barriers. Effatpanah et al.'s (2019) diagnosis of EFL writing competencies among Iranian university students identified vocabulary use and content fulfilment as particularly challenging areas, demonstrating CDA's precision in pinpointing specific skill deficiencies. However, as Emmanuel and Ekpo (2021) caution, institutional factors such as the absence of dedicated diagnostic periods in school timetables can substantially undermine CDA's potential benefits.

The technical complexities of CDA implementation continue to pose significant challenges, from model selection dilemmas (Javidanmehr et al., 2017) to resource constraints (Toprak & Cakir,

2021). Nevertheless, Tang and Zhan's (2021) research affirms that when effectively implemented, cognitive diagnostic feedback can substantially enhance learning outcomes, particularly in conceptually demanding domains. This growing body of international evidence positions CDA as a transformative assessment paradigm, albeit one requiring careful contextual adaptation and sustained institutional support to realise its full pedagogical potential.

In Malaysia, Huan and Chew (2022) conducted a study to develop an online Cognitive Diagnostic Assessment (CDA) for evaluating primary school students' mastery of the *relationship of time*. The study surveyed 90 Grade 4 students in Penang state. Findings revealed that some students demonstrated proficiency in converting time from smaller to larger units. Additionally, the study suggested that online CDA could serve as a reliable tool for mathematics teachers to identify students' cognitive strengths and weaknesses in this domain. However, the development of cognitive tests necessitated rigorous validation to ensure the reliability and validity of subsequent skill classifications (Routledge, 2022).

Listening is a critical language skill, and its assessment has been explored through Cognitive Diagnostic Modelling (CDM). Effatpanah (2018) investigated the application of CDM in the listening component of the International English Language Testing System (IELTS). The study pursued two key objectives: (a) evaluating multiple cognitive diagnostic models including a general model (G-DINA), two non-compensatory models (DINA and NC-Rum), and three compensatory models (ACDM, DINO, and C-Rum) to determine the most effective model for explaining attribute interactions in IELTS listening, and (b) assessing the performance of Iranian IELTS candidates in the listening section. Data from 310 Iranian test-takers were analysed, with model comparisons conducted using absolute and relative fit indices. Results indicated that the G-DINA model was the most effective, followed by C-Rum, ACDM, NC-Rum, DINO, and DINA. A subsequent study employing C-Rum further revealed that referencing, alongside vocabulary and syntactic comprehension, posed the greatest challenges for Iranian candidates. However, Taatgen et al. (2016) cautioned that CDM application can be complex due to difficulties in ensuring model accuracy, as multiple models may fit the same dataset.

Writing, another essential language skill, has also been examined through CDM frameworks. Shi et al. (2024) assessed the writing abilities of 1,166 Chinese English as a Foreign Language (EFL) learners using polytomous CDMs, specifically the G-DINA model. Results demonstrated that G-DINA effectively identified learners' strengths and weaknesses, offering valuable diagnostic

insights for personalised instruction. Nevertheless, Meisuri and Ekayati (2023) argued that teachers may face challenges in interpreting assessment outcomes due to insufficient training in diagnostic methodologies.

Beyond linguistic competence, writing serves as a medium for emotional and cognitive expression. Kim (2011) investigated English for Academic Purposes (EAP) writing ability using the reduced reparametrized Unified Model (reduced RUM). Ten ESL teachers evaluated 480 TOEFL iBT writing tests. The study found that the skills diagnosis approach yielded accurate and reliable classifications of skill mastery, with high discriminant validity and minimal instances of flat proficiency profiles. Despite these advantages, Javidanmehr and Sarab (2017) argued that while CDA can help identify learners mastered and unmastered skills, its novelty and complexity limit its current practical utility.

Reading fluency is another crucial skill for language learners. Toprak-Yıldız (2021) conducted a large-scale diagnostic study of reading abilities among 4,324 Grade 4 students from 19 European Union (EU) member states, using data from the 2016 Progress in International Reading Literacy Study (PIRLS). Log-linear cognitive diagnosis modelling (LCDM) was employed, revealing that this approach provided more granular diagnostic insights than traditional aggregated scoring methods. Conversely, Liu and Huggins (2018) cautioned against retrofitting non-diagnostic assessments for cognitive diagnosis, emphasising that tests should be designed *a priori* for diagnostic purposes. They argued that retrofitting may lead to misalignment between test items and intended cognitive skills, necessitating careful validation (Noh & Matore, 2024).

Javidanmehr and Sarad (2019) explored the retrofitting of a non-diagnostic reading comprehension assessment using the G-DINA model. Their study analysed a high-stakes L2 reading comprehension test from an Iranian PhD entrance examination, involving 10 candidates (5 male, 5 female). The study assessed multiple subskills, including vocabulary and syntactic knowledge, inferencing, explicit information comprehension, and text synthesis. Results indicated that test-takers performed optimally in vocabulary, syntax, and inferencing but struggled with higher-order synthesis tasks. However, Liu et al. (2017) maintained that not all assessments are suitable for retrofitting, highlighting potential limitations in diagnostic generalisability.

Proficiency in mathematics is a critical educational priority worldwide. Wu et al. (2020) conducted a large-scale comparative study examining mathematics learning trajectories across ten countries using Programme for International Student Assessment (PISA) data. The study analysed responses

from 24,512 students, categorising cognitive attributes into three dimensions: content, process, and context. A linear logic model (LLM) was employed, revealing distinct learning trajectories: students from Australia, Canada, the United Kingdom, and Russia exhibited comparable patterns, whereas those from the United States and Saudi Arabia followed a comparatively simplified trajectory. The study provided valuable insights into cross-national disparities in the mastery of eleven cognitive attributes, offering a framework for interpreting PISA outcomes and informing mathematics education policy. However, Shahmirzadi (2023) cautioned that retrofitting non-diagnostic items for cognitive diagnostic assessment (CDA) may introduce measurement bias, underscoring the necessity of purpose-built diagnostic instruments.

Further exploring adaptive learning methodologies, Wu and Chang (2020) investigated the integration of cognitive diagnosis within a dynamic assessment framework for spatial geometry. Employing a quasi-experimental design, the study divided 116 junior high school students into experimental and control groups. The experimental group received adaptive interventions tailored to their diagnostic results, while the control group engaged in self-directed, non-adaptive remediation. Findings indicated that adaptive learners demonstrated higher efficiency, requiring less time to rectify misconceptions. Complementing this, Noh and Matore (2024) highlighted the utility of real-time adaptive CDA, wherein assessment parameters dynamically adjust based on learner responses, optimising diagnostic precision.

The domain of temporal reasoning in mathematics was examined by Ling et al. (2017), who developed a CDA to diagnose primary pupils' mastery of chronological sequencing (e.g., determining dates after a specified duration). A panel of seven mathematics education experts validated the instrument, which was administered to 238 Grade 6 pupils in Penang, Malaysia. Analysis revealed 18 distinct knowledge states, illustrating the granularity of learners' conceptual understanding. While such tailored assessments yield precise diagnostic data, Matore and Noh (2024) noted the inherent time constraints in developing bespoke CDA instruments.

Learning progression mapping was advanced by Wancham and Tangdhanakanond (2023), who constructed a cognitive diagnostic learning path for Work and Energy among 537 Thai high school students. The framework delineated six attributes (e.g., kinetic energy, conservation laws), enabling teachers to personalise instruction and monitor incremental mastery. Similarly, Chin et al. (2022) validated a Rasch-based CDA for Parallel and Perpendicular Lines, identifying persistent difficulties in geometric property application among Malaysian Year 4 students.

Nevertheless, Noh et al. (2024) observed that resource limitations often impede CDA implementation in under-resourced settings.

CDA in Language Education and Differentiated Instruction

The diagnostic potential of CDA extends to language education. Ranjberan and Alavi (2017) developed a reading comprehension CDA using the Reparametrized Unified Model (RUM), administering a 20-item test to 1,986 Iranian university students. Diagnostic analysis revealed nine discrete reading attributes, informing targeted instructional interventions. However, Chew and Chin (2023) cautioned that heterogeneous classrooms pose significant challenges for differentiated instruction, necessitating robust validation of diagnostic tools.

Meisuri and Ekayati (2023) explored CDA implementation in differentiated English curricula, interviewing seventh-grade teachers. While teachers acknowledged CDA's utility in identifying learner needs, time constraints and student attitudes emerged as barriers. Sujinah et al. (2024) further demonstrated CDA's efficacy in competency profiling, with 60% of 139 students achieving proficiency across multiple text genres, enabling tailored pedagogy.

Diagnostic Feedback and Science Education

Kim (2015) leveraged the Fusion Model to diagnose L2 reading skills among 1,982 ESL learners, identifying ten critical attributes for curriculum enhancement. On the other hand, Paris (2022) noted that excessive teacher workloads may compromise feedback quality. In science education, Peng et al. (2023) validated a seven-attribute CDA for *knowledge-in-use*, revealing reliable cognitive patterns among 530 Grade 10 students. Monarrez and Tchoshanov (2020), however, emphasised the challenges of aligning such assessments with curricular standards.

Chuan et al. (2020) conducted a quasi-experimental study examining the differential impact of feedback granularity within online Cognitive Diagnostic Assessments (CDA) on Malaysian elementary students' mastery of temporal concepts. The sample comprised 125 Grade 5 pupils across six schools, with the experimental group receiving elaborated feedback (for example conceptual explanations and remedial prompts) and the control group receiving minimal correctness feedback. Results demonstrated significantly greater learning gains in the experimental cohort ($p < .05$), corroborating Khechane et al.'s (2020) assertion that nuanced feedback facilitates

cognitive restructuring and conceptual depth. This aligns with formative assessment paradigms emphasising metacognitive engagement (Black & Wiliam, 2018), though implementation fidelity remains contingent on teacher capacity (Ramdan et al., 2024).

Cognitive Architectures in Science Education

Qi et al. (2024) employed Bayesian network analysis to model hierarchical attribute structures in redox reaction comprehension among 409 Chinese upper-secondary students. The study identified seven latent attributes, with 'electron transfer' and 'oxidability/reducibility' constituting foundational nodes. Cross-grade comparisons revealed pronounced developmental disparities: Grade 12 learners exhibited consolidated cognitive schemata (mastery probability = 0.78), whereas Grade 11 cohorts demonstrated fragmented understanding (mastery probability = 0.42), indicative of curricular sequencing effects. While Bayesian networks proved robust for cognitive mapping, Ramdan et al. (2024) cautioned that temporal constraints may impede teachers' ability to operationalise such diagnostic insights.

Language Assessment Innovations

Utami et al. (2024) pioneered a CDA framework for assessing *Mahārah istimā'* (listening proficiency) in Indonesian senior high schools, employing a mixed-methods documentary analysis. Their instrument featured 10 polytomous items balancing retrospective (20%) and prospective (60%) content coverage, with item formats spanning multiple-choice and constructed response paradigms. Despite its diagnostic potential, scalability is constrained by systemic professional development deficits (Ramdan et al., 2024), echoing global challenges in CDA implementation (Javidanmehr et al., 2017).

Cross-National Mathematics Competency Analysis

Wu et al. (2022) conducted a large-scale comparative study of mathematical key competencies using PISA data (N=19,454) from eight nations, applying log-linear cognitive diagnosis modelling (LCDM). Chinese students outperformed peers across all six PISA competencies particularly in logical reasoning (Cohen's $d = 1.2$) while Anglophone and Nordic nations exhibited relative

weaknesses in abstract reasoning domains. Herbert (2021) problematised these findings, noting that assessment-design disconnects from curricular guidance may artefactually depress performance metrics.

Writing Diagnostics in EFL Contexts

Xiaoting et al. (2023) advanced polytomous CDM applications through their study of 1,166 Chinese EFL learners, validating the SG-DINA model's superiority in diagnosing micro-skills (AIC = 2,345.7; BIC = 2,401.2). Parallel findings emerged from He et al. (2021), whose linear logistic model analysis of 460 undergraduates revealed significant inter-proficiency disparities in sociolinguistic knowledge ($\eta^2 = .18$). However, Hoth et al. (2016) highlighted practitioner challenges in translating diagnostic data into differentiated instruction a concern amplified by institutional resistance to paradigm shifts (Seipel, 2018).

Psychometric Innovations and Limitations

Aryadoust's (2018) comparative model fitting of five CDMs for O-level listening tests (N=1,502) established the reduced reparameterized unified model (RRUM) as optimal (RMSEA = .04), identifying distractor susceptibility as a critical latent trait. Conversely, Xu et al. (2023) demonstrated the DINA model's utility in mapping nonlinear learning trajectories in TIMSS mathematics data (N=573), though Lee (2015) cautioned against overreliance on single-model approaches given inherent identification challenges.

Implementation Barriers and Scalability Challenges in Cognitive Diagnostic Assessment

The implementation and scalability of Cognitive Diagnostic Modelling (CDM) in educational assessment contexts continue to face significant systemic barriers that warrant critical examination. Recent empirical investigations by Mohammed et al. (2023) and Khalilpour et al. (2024) have collectively identified several persistent challenges that constrain the effective application of CDM methodologies across diverse educational settings. A primary concern lies in the substantial technical capacity deficits observed among teachers, with Javidanmehr et al.'s (2017) survey data revealing that only 12% of participating teachers reported proficiency in utilising specialised CDM software, highlighting a critical gap in professional training and technical support infrastructure. This skills shortage not only limits independent implementation

by classroom practitioners but also fosters an unsustainable reliance on external assessment specialists, thereby undermining institutional autonomy in diagnostic assessment practices.

Further complicating widespread adoption are the stringent sample size requirements necessary to ensure psychometric robustness, as Mazur (2022) has demonstrated that datasets comprising fewer than 1,000 respondents frequently yield parameter estimates with unacceptably large standard errors ($SE > 0.3$), potentially compromising the reliability of diagnostic classifications. This presents particular challenges for smaller educational institutions or those operating in resource-constrained environments where large-scale standardised testing frameworks may be underdeveloped or impractical to implement. Equally problematic are the persistent methodological challenges surrounding validation protocols, exemplified by Wafa's (2023) study of Afghan secondary mathematics students ($N = 274$), which reported a 32% misclassification rate when applying the Deterministic Input, Noisy "And" gate (DINA) model, a finding attributed by Yansa and Retwati (2021) to inadequate validation procedures and contextual adaptation of diagnostic instruments.

These interrelated barriers collectively suggest that while CDM approaches offer theoretically compelling advantages for personalised learning and targeted intervention strategies, their practical implementation remains constrained by multiple factors including technical capacity limitations, resource-intensive data requirements, and unresolved methodological challenges in validation frameworks. The current landscape indicates an urgent need for focused research and development initiatives aimed at creating more accessible CDM tools with lower technical barriers to entry, alongside the establishment of robust, context-sensitive validation protocols that can accommodate diverse educational environments. Furthermore, systemic investment in professional development programmes will be essential to build sustainable institutional capacity for effective implementation, particularly in regions where assessment infrastructures are currently underdeveloped. Addressing these challenges will be crucial for realising the full potential of cognitive diagnostic approaches in enhancing educational assessment practices and improving learning outcomes across varied contexts.

Recent research has significantly advanced our understanding of cognitive diagnostic assessment (CDA) applications across diverse educational contexts. Wu et al. (2025) conducted a comprehensive examination of Mainland Chinese students' mathematical performance within the

Trends in International Mathematics and Science Study (TIMSS) framework, comparing their achievements with other high-performing nations while analysing learning trajectories. Their study, involving 4,733 eighth-grade students from four Chinese provinces, employed the G-DINA model to identify eight distinct mathematical cognitive attributes. The findings revealed strong mastery in fundamental processes including calculation and measurement (CM), operation and solution (OS), and representation modelling (RM), though notable variations in knowledge states were observed among students. However, as Javidanmehr et al. (2017) caution, the construction of Q-matrices for such analyses remains a time-intensive process that may limit practical implementation.

Parallel developments in primary mathematics assessment have been demonstrated by Haghayeghi et al. (2024), who developed a first-grade mathematics (FG-M) diagnostic checklist comprising 74 items. Administered to 1,018 students, this instrument reliably identified specific conceptual difficulties in multiplication, temporal understanding, and geometric principles. While this represents significant progress in early mathematics diagnostics, Mazur (2022) appropriately notes the inherent challenges in translating cognitive frameworks into effective assessment instruments, particularly when addressing complex conceptual domains.

The utility of CDA extends beyond subject-specific diagnostics into broader educational evaluation. Prihartono and Rustam's (2024) Indonesian study illustrated how cognitive diagnostic approaches could inform pedagogical strategies by identifying individual learning requirements based on cognitive profiles. Nevertheless, Yansa and Retwati (2021) provide an important caveat regarding student-related implementation barriers, particularly motivational factors that may undermine assessment effectiveness. This concern finds resonance in Abbood et al.'s (2025) investigation of Iranian and Iraqi MA students' English language proficiency, which, while successfully identifying specific linguistic weaknesses through cognitive profiling of 25 participants, also highlighted the practical constraints of personalised instruction - notably the temporal demands on teachers (Ramdan et al., 2024).

Medical education has similarly benefited from cognitive diagnostic approaches, as evidenced by Bangeranye and Lim's (2020) analysis of 200 first-year medical students. Their research demonstrated CDA's capacity to monitor instructional quality through detailed attribute mastery profiling, though Holth et al. (2016) rightly question the precision of error identification in such complex diagnostic contexts. Meanwhile, Viclara's (2025) experimental study of fluid dynamics

comprehension among Indonesian junior high students provided compelling evidence for the efficacy of project-based learning combined with optimised CDA, showing statistically significant improvement ($p < 0.001$) with an average gain score of 24.34.

The integration of CDA with established language frameworks has yielded particularly insightful results. Mei and Chen (2022) successfully mapped translation competencies against China's Standards of English (CSE) through linear logistic modelling of 458 students' work, revealing proficiency-dependent attribute mastery patterns. However, as Taatgen et al. (2022) observe, model interpretability remains a persistent challenge that may limit practical adoption. Similar methodological sophistication characterises Fan and Yan's (2020) examination of Chinese EFL reading abilities, where a taxonomy-derived Q-matrix enabled detailed profiling of 978 students across nine cognitive attributes. The subsequent development of multi-layered diagnostic reports represents a significant advancement, though Sesson and Henson's (2018) finding regarding underutilisation of such data by teachers suggests important implementation barriers.

Zhang et al.'s (2024) construction of a CSE-aligned English reading diagnostic model for 200 university students further demonstrates the potential of personalised performance reporting, while Bui's (2024) insights into feedback preferences highlight important psychosocial considerations in implementation. In the vocational domain, Helm et al.'s (2023) Austrian study of 773 business students showcased CDA's capacity to identify both group and individual accounting skill profiles, though Liu et al. (2025) appropriately note the challenges posed by examination-focused educational cultures.

At the classroom level, Huang and Wu's (2013) innovative application of person-facet and item-facet indices to analyse 32 Taiwanese students' mathematical misconceptions represents a valuable micro-level perspective. Their identification of four distinct response pattern classes provides nuanced understanding of fractional concept mastery, while Ramdam et al.'s (2024) observations regarding professional development gaps underscore systemic barriers to widespread CDA adoption.

Collectively, these studies demonstrate both the considerable potential and ongoing challenges of cognitive diagnostic approaches. While technological and methodological advances continue to enhance diagnostic precision, successful implementation requires parallel attention to teacher training, resource allocation, and cultural adaptation of assessment practices. Future research must

particularly address the translation of diagnostic insights into actionable pedagogical strategies while considering the practical constraints of diverse educational contexts.

Shabani (2018) conducted a study to shed light on the mental processes that the examinees went through in responding to the multiple-choice questions of four reading comprehension passages, elicited from the recent Iranian University Entrance Exam 2015. The participants were forty female students aged between 16 and 17 years old, who made up the control and the experimental groups in an EFL context at a high school to help them enhance their reading comprehension skills and strategies by giving proper diagnostic feedback and intervention. The results of this study revealed the usefulness of consistent CDA for both the teacher and the learners. However, teachers may feel overwhelmed by the amount of data they are expected to manage (Deluca et al.,2024).

Wu (2019) conducted a study to develop an online individualized tutor for improving Mathematics learning using the Cognitive Diagnostic Model. An experiment was conducted in practical educational settings exploring the effectiveness of the online tutor remedial programme based on diagnostic reports of the CDM. The study was conducted on 84 grade four students from the elementary schools. The results showed that the online individualized tutor program exceeded the traditional remedial instruction program. It was beneficial for all students, especially for medium and low-achieving students. Wu (2019) further indicated that CDA is rarely used in Mathematics due to practical constraints.

Anisah (2024) conducted a study to spotlight the importance of evaluating students' reading skills comprehensively, not just based on final grades. In this study, a digital cognitive diagnostic assessment was used to detect students' accuracy and tendency in answering questions, helping to identify students who answered by guesswork despite achieving high school. A reading test was administered to 70 students through a diagnostic assessment application. The results were analyzed using the Rasch model. The results showed that some students with high scores indicated a pattern of guessing. In the context of differentiated learning, high-scoring but less careful students could be grouped separately from more able students. However, However, Anisah (2024) further indicated that there have to be enough technological devices for teachers and learners.

Hasibuan, Ruhiat, and Santosa (2024) conducted a study to analyze the need for developing a cognitive diagnostic test instrument that can help teachers to map students' Mathematical abilities in essential topics while serving as an early identification tool for students showing signs of slow

learning in mathematics. 122 high school Mathematics teachers participated in Indonesia. They provided their perceptions regarding the need for a cognitive test. The results showed that developing a cognitive diagnostic test that could assess the mathematical abilities of learners was very important, so that those learners' needs could be identified and addressed. At the same time, Mohd Noh (2024) declared that teachers should ensure effective item development.

Li, Zhou, Gao, and Tu (2020) conducted the study to investigate the development of 245 Kindergarteners' Mathematics problem solving at two time points within 7 months using the Cognitive Diagnostic Test, which measured three cognitive components (Mathematical knowledge and skills, semantic understanding, and qualitative reasoning) with eleven cognitive attributes. The effects of five influencing factors, language ability, mathematics application ability, calculation ability, approaches to learning, and socio-economic status, on the children's mastery of mathematical ability at the two time points were examined. The results indicated that 245 children's mastery of mathematical knowledge and skills was much better than their mastery of semantic understanding and qualitative reasoning. However, Xiong et al. (2022) indicated that it is time-consuming to specify the attributes and Q-matrix manually.

Huang, Liu, Zi, Huang, and Pan (2022) conducted a study to develop and implement a multi-level remedial teaching scheme in various high school classes containing students of a wide range of learning levels and to determine its effect on their learning. DINA was used to classify students at multiple levels according to their knowledge and desired learning outcomes. 680 senior high school students from central provinces in China took part in the initial cognitive, and 1615 high school students from 7 high schools in China took part in a formal cognitive diagnostic test. 36 high school students from Southwestern China participated in think-aloud protocols, and 258 seniors from 3 high schools in Southwestern China participated in the remedial teaching experiment. Through analysis of students' think-aloud protocols, cognitive errors of students at all levels were determined, and multi-level remedial teaching programs were then implemented in three schools and compared with a control group. The results showed that the students in the experimental group showed a great improvement. However, implementing CDA requires a lot of time (Ramdam et al., 2024).

Recent research has demonstrated the growing application of Cognitive Diagnostic Assessment (CDA) across diverse educational settings, revealing both its potential and limitations. Liu, Hashim, and Sulaiman (2025) conducted an intervention study examining how CDA frameworks

could enhance IELTS speaking skills among Chinese EFL learners. Their 16-week programme with A2-level secondary students showed significant improvements across five linguistic domains, particularly in syntactic complexity and discourse management. However, the study also highlighted the technical challenges inherent in such systems, echoing Sun and Kang's (2022) concerns about the digital literacy requirements for effective CDA implementation.

The integration of artificial intelligence with diagnostic assessment has opened new possibilities for personalised learning. Gan et al. (2019) developed an innovative AI-tutor system that generated tailored remedial content based on CDA analysis, demonstrating particular efficacy in mathematics instruction. This technological approach, while promising, has been met with some scepticism. Hoth et al. (2016) argue that excessive reliance on digital platforms may paradoxically limit the personalisation they seek to achieve, suggesting that human mediation remains crucial in the diagnostic process.

Comparative studies of mathematical competence have yielded valuable insights into regional educational strengths and weaknesses. Zhang et al. (2025) analysis of PISA data from East Asian regions revealed Shanghai's consistent outperformance in abstract reasoning and logical thinking, while Hong Kong, Macau and Taiwan showed similar competency profiles. These findings align with broader observations about the challenges of developing higher-order thinking skills through diagnostic approaches, as noted by Monarrezzo and Tchoshanou (2020). The study's large sample size (N=6,561) lends weight to its conclusions, though questions remain about the transferability of such findings across different cultural contexts.

Methodological innovations continue to refine the precision of diagnostic assessment tools. Saso, Oka, and Uesaka (2023) developed a sophisticated mathematics assessment capable of distinguishing between surface-level and deep conceptual understanding, even among students with identical test scores. This granularity in diagnostic information represents a significant advance in formative assessment. However, as Mazur (2022) cautions, the psychometric complexity of such instruments raises important questions about their practical implementation in typical classroom settings.

The scalability of CDA tools has been demonstrated through several large-scale applications. Lin, Zhen, and Liu (2021) validation of their Diagnostic Chinese Reading Comprehension Assessment with over 21,000 primary students established the G-DINA model's effectiveness, while Romiah,

Rosidin, and Pramudiyanti's (2025) work in Indonesian elementary schools showed both validity and practicality in differentiated learning contexts. These successes notwithstanding, researchers consistently identify time constraints as a major barrier to implementation (Ramdam et al., 2024), suggesting that efficiency improvements must accompany diagnostic advances.

The literature reveals an ongoing tension between technological sophistication and pedagogical accessibility. Wu's (2024) game-based AI diagnostic system achieved impressive accuracy rates in identifying mathematical misconceptions, while Hamza and Touhami's (2024) incentivised intervention programme demonstrated measurable improvements in student confidence and test anxiety. These innovations point to CDA's potential to transform assessment practices, though they also highlight systemic challenges including teacher training needs (Mei & Chen, 2022) and time pressures in assessment design (Yansa & Retnawati, 2021).

As the field progresses, several key considerations emerge. First, the balance between diagnostic precision and practical applicability requires careful negotiation. Second, the cultural and contextual adaptability of CDA frameworks demands further investigation. Third, the professional development implications of widespread CDA adoption must be addressed. Future research would benefit from longitudinal studies tracking the sustained impact of diagnostic interventions, as well as comparative investigations of implementation strategies across different education systems.

The collective evidence suggests that while CDA offers powerful tools for understanding and addressing individual learning needs, its successful implementation depends on thoughtful integration with pedagogical practices, adequate support for teachers and consideration of local educational contexts. As the technology continues to evolve, maintaining this balance between innovation and practicality will be crucial for realising CDA's full potential in enhancing teaching and learning outcomes.

Recent scholarship has demonstrated the expanding application of Cognitive Diagnostic Assessment (CDA) across diverse educational settings, revealing both its transformative potential and persistent implementation challenges. Puente et al.'s (2023) examination of reading comprehension among Chilean university students (N=579) employed sophisticated psychometric modelling (LLTM and DINA) to evaluate cognitive, metacognitive and linguistic strategies. While the study provided granular insights into learner profiles, it simultaneously highlighted the

significant temporal investments required for effective CDA implementation (Liu et al., 2025) a recurring theme throughout the literature.

The technological dimension of diagnostic assessment has seen notable advancements, particularly in mathematics education. Huan and Chew's (2022) development of a web-based CDA system for temporal problem-solving demonstrated strong psychometric properties ($\alpha=.89$, CFI=.95), yet revealed concerning gaps in student mastery levels. Similarly, Wafa et al.'s (2020) comparative analysis of Afghan students' mathematical abilities through TIMSS data (N=274) yielded valuable diagnostic information, though Javidanmehr's (2017) caution about retrofitting validity remains pertinent. These studies collectively underscore the delicate balance between technological innovation and pedagogical practicality that characterises contemporary CDA research.

In primary education contexts, several innovative approaches have emerged. Reinita and Syahroh's (2024) Quizizz-assisted CDA for Pancasila education achieved exceptional teacher practicality ratings (92.75%), while Dewi's (2024) Indonesian language assessment instrument effectively measured higher-order thinking skills. However, as Liu et al. (2025) note, the efficacy of such tools remains contingent upon teachers' feedback delivery methods a crucial implementation factor often overlooked in technological development phases.

The STEM disciplines have particularly benefited from large-scale diagnostic applications. Le et al.'s (2024) physics concept inventory (N=19,889) demonstrated the DINA model's capacity to identify cross-content competencies with remarkable classification accuracy. Wu's (2024) game-based AI diagnostic system achieved 90.8% expert-validated accuracy in identifying mathematical misconceptions among secondary students. These technological advancements, however, face scepticism from scholars like Lodge et al. (2018), who question whether digital solutions genuinely enhance or inadvertently hinder personalised learning.

Language education research has produced compelling evidence for integrative CDA frameworks. Fan et al.'s (2021) four-phase model for EFL reading demonstrated significant impacts on both teacher practices and student outcomes, while Li et al.'s (2021) large-scale validation of the Diagnostic Chinese Reading Comprehension Assessment (N=21,466) established G-DINA as the optimal model for primary reading diagnostics. These successes are tempered by persistent challenges, particularly the tension between diagnostic approaches and examination-oriented traditions (Liu et al., 2025).

The African context presents a particularly striking research gap in diagnostic assessment literature. This study is going to add more literature in exploring practising teachers' experiences in using CDA, as a diagnostic assessment in their classrooms. While studies like Delga's (2019) Ethiopian physics investigation (N=108) have begun exploring CDA applications, the continent's assessment research remains overwhelmingly focused on summative paradigms (Bello & Athiyah-Abdullah, 2020; Owoseni et al., 2024). Lesotho's educational research exemplifies this trend, with multiple studies (Thamae, 2023; Chere-Masopha & Mothetsi-Mothiba, 2022) examining continuous assessment systems while largely neglecting diagnostic approaches.

Critical Considerations in the Implementation of Cognitive Diagnostic Assessment

The current body of research on Cognitive Diagnostic Assessment (CDA) reveals several fundamental tensions that shape both its theoretical development and practical application in educational settings. Foremost among these is the inherent conflict between diagnostic precision and practical implementation. While studies such as Puente et al. (2023) demonstrate CDA's capacity to provide granular insights into individual learning profiles through sophisticated psychometric modelling, the significant temporal and technical resources required often render such approaches impractical for widespread classroom application (Liu et al., 2025). This dichotomy is particularly evident in web-based diagnostic systems, where despite demonstrating strong psychometric properties (Huan & Chew, 2022), the practical utility remains constrained by institutional capacity and teacher technological literacy (Ekayati & Meisuri, 2023).

A second critical consideration involves the integration of technological solutions within assessment systems. The proliferation of digital diagnostic tools, from AI-driven platforms (Wu, 2024) to gamified assessment environments (Reinita & Syahroh, 2024), has undoubtedly expanded the possibilities for personalised learning. However, as Lodge et al. (2018) caution, technological sophistication does not automatically translate to pedagogical effectiveness. The literature suggests that optimal implementation requires a balanced approach where technological solutions are carefully aligned with established educational objectives and classroom realities (Fan et al., 2021). This is particularly relevant in contexts where digital infrastructure may be limited or where teachers lack confidence in utilising advanced assessment technologies (Kim & Lee, 2020).

Persistent challenges in teacher capacity building and feedback delivery represent a third major theme emerging from the research. Multiple studies (Meisuri & Ekayati, 2023; Heri et al., 2024) highlight how the effectiveness of CDA is fundamentally contingent upon teachers' ability to interpret diagnostic data and translate it into meaningful pedagogical interventions. The case of Lesotho's education system (Thamae, 2023; Chere-Masopha & Mothetsi-Mothiba, 2022) exemplifies how even well-designed diagnostic tools may fail to achieve their potential without adequate teacher training and support structures. This challenge is compounded by the varying ways in which feedback is delivered and received across different cultural and educational contexts (Liu et al., 2025), suggesting the need for more nuanced approaches to professional development in diagnostic assessment practices.

Perhaps most striking are the significant geographical disparities in CDA research and application. While developed education systems have produced sophisticated diagnostic models (Li et al., 2021; Le et al., 2024), many regions, particularly in Africa, remain focused on traditional summative assessment paradigms (Bello & Athiyah-Abdullah, 2020; Owoseni et al., 2024). The limited adoption of diagnostic approaches in these contexts (Delga, 2019) points to broader systemic challenges including resource constraints, assessment policy orientations, and research capacity limitations. These disparities not only affect educational equity but also limit the diversity of perspectives in the global discourse on assessment innovation.

The literature collectively suggests that successful CDA implementation requires a multifaceted approach. Thoughtful integration with existing pedagogical practices emerges as a critical factor, particularly in avoiding the common pitfall of treating diagnostic tools as standalone solutions rather than components of a holistic teaching and learning process (Fan et al., 2021). This integration must be supported by substantial investment in teacher professional development that goes beyond technical training to encompass the interpretive and pedagogical skills needed to act on diagnostic data (Heri et al., 2024).

Equally important is the careful consideration of local educational contexts and resource constraints. The research demonstrates that diagnostic tools developed for well-resourced systems often prove impractical or irrelevant in different settings (Javidanmehr, 2017; Liu et al., 2025). This underscores the need for context-sensitive approaches to CDA development and

implementation, particularly in regions where assessment systems are undergoing transformation (Ayanwale et al., 2024).

Finally, the literature emphasises the importance of ongoing validation of technological solutions against actual educational outcomes. While numerous studies report strong psychometric properties for various diagnostic tools (Huan & Chew, 2022; Wu, 2024), there remains a need for more longitudinal research examining how these tools ultimately affect learning trajectories and teaching practices across diverse contexts. This is particularly crucial as educational technology continues to evolve rapidly, often outpacing the evidence base for its effectiveness (Lodge et al., 2018).

In conclusion, while CDA represents a significant advancement in educational assessment, its potential can only be fully realised through approaches that balance innovation with practicality, technology with pedagogy, and global perspectives with local realities. Future research should prioritise: the development of more efficient diagnostic methodologies that maintain precision while reducing implementation burdens; culturally adaptive frameworks for teacher professional development in diagnostic practices; and greater attention to underrepresented regions in the global assessment discourse. Only through such comprehensive approaches can CDA truly transform educational outcomes across diverse learning contexts.

2.4 APPRAISAL OF LITERATURE AND GAP

Extensive international research has investigated the application of Cognitive Diagnostic Assessment (CDA) across primary, secondary, and tertiary education, evaluating learners' conceptual understanding in diverse academic domains. These studies have predominantly been conducted in developed and emerging economies, including Iran, China, the European Union, Malaysia, Thailand, the United States, Indonesia, and Afghanistan. Collectively, they provide robust insights into learners' cognitive strengths and weaknesses, facilitating targeted pedagogical interventions.

For instance, researchers in Iran adapted the IELTS reading section for large-scale cognitive diagnostic analysis among university students. While their methodological approach demonstrated the feasibility of repurposing existing assessments for CDA, the study was confined to Iran and did not examine the practical challenges of CDA implementation in classroom settings—a gap this

study seeks to address. Similarly, another investigation assessed the writing competencies of Iranian EFL learners, identifying specific subskills that posed difficulties. However, the study omitted guidance on how teachers might utilise such diagnostic data to inform instructional strategies an area this research will explore within Lesotho's educational context.

Further afield, a large-scale study of 1,166 Chinese EFL learners employed polytomous cognitive diagnostic models (CDMs) to evaluate writing proficiency. Although the researchers proposed generating individualised diagnostic reports, they did not consider potential obstacles teachers might encounter in compiling and applying such data an issue particularly relevant in resource-constrained settings like Lesotho. Meanwhile, an analysis of 4,324 Grade 4 pupils across 19 EU nations participating in the 2016 PIRLS assessment yielded detailed diagnostic insights into reading comprehension. Nevertheless, the study relied on an assessment tool not originally designed for CDA, and the researchers did not elucidate how teachers might adapt such methods to meet classroom-specific needs.

Other studies have employed advanced psychometric models, such as the Reduced Reparametrized Unified Model (RUM), to classify learners based on writing skill mastery. While these investigations underscore the diagnostic potential of CDA, they neglect the logistical and pedagogical challenges teachers face when integrating such assessments into instruction. A separate study examined teachers' perceptions of diagnostic assessment (DA) more broadly, focusing on factors influencing assessment literacy but without specific attention to CDA. Given Lesotho's distinct educational landscape, local teachers' attitudes and experiences with CDA may differ significantly from those in developed contexts, warranting focused investigation.

Research has also explored CDA's role in differentiated instruction, highlighting its benefits while acknowledging implementation challenges. For example, one study developed an online CDA system to assess students' grasp of temporal relationships, demonstrating the practical utility of diagnostic tools. However, with a sample size ($n=90$) exceeding typical classroom capacities, the findings may lack generalisability to standard teaching environments. Crucially, none of these studies addressed the barriers teachers encounter when administering CDA or strategies to mitigate them an omission this study will rectify.

Further gaps persist in the literature. A study on adaptive dynamic assessments for spatial geometry learning incorporated cognitive diagnostics but did not examine teachers' familiarity with CDA or its classroom applicability. Similarly, research diagnosing primary pupils' conceptual

understanding provided granular insights into learning gaps but overlooked the challenges of CDA implementation. This study will not only identify such challenges but also propose training frameworks to enhance teacher competency in CDA utilisation.

Notably, while some studies have leveraged CDA to personalise learning in differentiated classrooms, they have not explored teachers' perceptions of its integration into lesson planning—an area critical for sustainable adoption. Likewise, investigations into the English proficiency of Iranian and Iraqi MA students using CDMs focused solely on subskill identification, neglecting the practical constraints of CDA application in real-world teaching scenarios. Even in studies advocating for technology-enhanced CDA (e.g., online mathematics tutoring platforms), researchers did not address the systemic or pedagogical hurdles faced by educators in low-resource contexts like Lesotho.

The Lesotho Context: Bridging the Research Gap

As a developing nation, Lesotho exhibits distinct socioeducational characteristics that may hinder the direct applicability of research findings derived from high-income countries. The nation's educational infrastructure, resource availability, and teacher training frameworks differ significantly from those in more economically advanced contexts where Cognitive Diagnostic Assessment (CDA) has been extensively studied. Presently, there remains a conspicuous gap in the literature concerning Basotho teachers' firsthand experiences with CDA, their perceptions of its diagnostic efficacy, and the institutional support mechanisms necessary for its sustainable implementation. Given that teachers serve as the primary agents of assessment practices within classrooms, a systematic exploration of their perspectives on CDA is not only warranted but critical for its successful adoption. Implementing CDA is beneficial as it offers teachers detailed insights into students' strengths and areas for improvement, enabling them to customize their teaching methods.

This study seeks to address this research lacuna through three principal objectives. First, it will examine the practical and systemic challenges that Lesotho's teachers encounter when attempting to integrate CDA into their pedagogical practices. Such challenges may include, but are not limited to, limited access to training, insufficient technological resources, and curricular constraints that prioritise summative over diagnostic assessment. Second, the study will assess teachers' perceptions regarding the utility of CDA in identifying and remedying learners' cognitive gaps. Understanding whether educators view CDA as a valuable tool or conversely, as an impractical

imposition will provide crucial insights into its potential for long-term adoption. Finally, the research will propose evidence-based strategies to facilitate the effective incorporation of CDA into classroom practice. These strategies may include tailored teacher training programmes, the development of contextually appropriate diagnostic tools, and policy recommendations to align CDA with Lesotho's broader educational objectives.

By addressing these underexplored dimensions, this study made a substantive contribution to the extant literature on educational assessment in Lesotho. While previous research has largely focused on CDA's theoretical and psychometric dimensions in developed contexts, this investigation will foreground the lived experiences of teachers in a resource-constrained setting. The findings will not only enrich academic discourse but also hold practical significance for policymakers and teacher training institutions. Specifically, they may inform the design of professional development initiatives aimed at enhancing assessment literacy, ultimately fostering more responsive and equitable teaching practices. In doing so, this research has the potential to bridge the gap between diagnostic assessment theory and classroom praxis, ensuring that CDA is not merely an academic exercise but a transformative tool for improving learner outcomes in Lesotho.

Thus, the study is positioned to fill a critical void in the literature while simultaneously offering actionable recommendations to strengthen Lesotho's educational assessment framework. In a landscape where global pedagogical trends often overshadow local realities, this research underscores the necessity of context-sensitive approaches to educational innovation ensuring that CDA is not merely transplanted, but thoughtfully adapted to meet the unique needs of Basotho teachers and learners.

2.5 Conclusion

This study has illuminated the significant potential of Cognitive Diagnostic Assessment (CDA) as a tool for enhancing pedagogical precision and improving learning outcomes. While existing research underscores CDA's theoretical and practical benefits, the findings reveal a critical gap in understanding its implementation within Lesotho's unique educational context. The challenges faced by Basotho teachers including limited resources, assessment literacy disparities, and curriculum constraints highlight the need for context-sensitive approaches to CDA adoption. By exploring teachers' experiences and perceptions, this research provides actionable insights for

policymakers and teacher training programmes, advocating for tailored professional development to facilitate effective CDA integration. Ultimately, the study contributes to the broader discourse on diagnostic assessment by bridging the gap between theory and practice in under-researched settings, ensuring CDA's transformative potential is realised equitably across diverse educational landscapes.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter delineates the methodological framework employed in the present study. It expounds upon the research paradigm, design, and approach; the procedures for data collection and analysis; the sampling strategy; the contextual setting of the study and its participants; the baseline assessment and training protocol; and the measures implemented to ensure methodological rigour, trustworthiness, and adherence to ethical standards. The chosen methodology (qualitative research methodology, interpretive methodological approach) aligns with the study's overarching objective of examining practising teachers' experiences, perceptions, and challenges in implementing Cognitive Diagnostic Assessment (CDA) within classroom contexts.

3.1 RESEARCH PARADIGM

A research paradigm serves as the philosophical and theoretical bedrock that informs every facet of the research process, from the articulation of research questions to the design, data collection, analysis, and interpretation of findings (Olabiyi, 2020). It encapsulates the researcher's fundamental assumptions regarding the nature of reality, the mechanisms of knowledge production, and the value systems underpinning scholarly inquiry. The selection of an appropriate paradigm is thus pivotal, ensuring methodological coherence with the study's objectives and the intrinsic characteristics of the phenomena under scrutiny.

This study is situated within the interpretivist paradigm, which posits that reality is socially constructed, contextually contingent, and inherently subjective (Turin, Raihan, & Chowdhury, 2024). Interpretivism contends that social phenomena cannot be meaningfully apprehended in isolation from the individuals who experience them; rather, they must be examined through the lived experiences, interpretations, and meaning-making processes of those directly engaged (Saunders et al., 2012). Given that practising teachers exhibit diverse perspectives, pedagogical beliefs, and experiential understandings of Cognitive Diagnostic Assessment (CDA), these variations resist reduction to statistical generalisations. Instead, they necessitate an approach capable of elucidating the depth and multiplicity of individual realities.

Within the interpretivist framework, the researcher is not a detached, neutral observer but an active participant in the co-construction of meaning. Reality emerges through intersubjective engagement, and the researcher's interactions with participants constitute a vital conduit for understanding. In consequence, the emphasis lies not on the formulation of universal laws but on the generation of rich, contextually embedded insights that illuminate the complexities of teachers' professional experiences.

Ontological Assumptions: The Nature of Reality

Ontology pertains to the researcher's foundational assumptions concerning the nature of existence what can be known and how it is constituted (Cohen et al., 2018). From an interpretivist perspective, reality is pluralistic, subjective, and mediated by social, cultural, and situational factors (Kuvunja & Kuyini, 2017). This study proceeds from the premise that each teacher embodies a distinct reality, shaped by their pedagogical convictions, institutional milieu, instructional environment, and prior encounters with CDA.

For instance, a teacher in a well-resourced urban school may regard CDA as an intellectually enriching and logistically feasible tool, whereas a counterpart in an under-resourced rural setting may perceive it as an impractical imposition due to infrastructural constraints. Both perspectives are ontologically valid within their respective contexts. As the researcher, I engaged directly with participants in their natural environments classrooms, staffrooms, and school settings recognising that my role was inextricably linked with theirs in the dialogic construction of meaning (Halmers, Manley, & Wasserman, 2005). This ontological stance affirms the coexistence of multiple truths, eschewing the pursuit of a singular, objective reality in favour of a nuanced appreciation of situated experiences.

Epistemological Stance: The Nature of Knowledge

Epistemology addresses the principles governing the acquisition, validation, and interpretation of knowledge (Cohen et al., 2018). Within interpretivism, knowledge is dialogically constructed, emerging through social interaction, reflexive negotiation, and hermeneutic engagement. Rather than seeking to uncover context-independent ‘facts,’ the researcher prioritises the emic perspective the insider’s lived experience (Cooksey & Macdonald, 2011).

In this study, knowledge pertaining to teachers’ engagement with CDA was generated through interactive, meaning-centred methods, including semi-structured interviews, classroom observations, and document analysis. These techniques facilitated opportunities for teachers to articulate their perceptions, narrate personal experiences, and critically reflect on their assessment practices. The epistemological orientation was not directed towards the quantification of variables but towards elucidating the subjective meanings teachers ascribe to their professional actions. Moreover, this approach acknowledged the reflexive dimension of inquiry, wherein the research process itself could catalyse deeper introspection among participants, thereby enriching the empirical data.

Axiological Considerations: Values and Ethical Reflexivity

Axiology examines the role of values, ethics, and researcher positionality in shaping the research endeavour (Pretorius, 2024). Interpretivist research does not seek to expunge values but rather to foreground them through transparency, reflexivity, and ethical vigilance. In this study, the values and worldviews of teachers inflected by cultural backgrounds, pedagogical philosophies, and professional trajectories were recognised as constitutive of their narratives about CDA.

Concurrently, I critically examined my own positionality, including my professional background in assessment practices, which inevitably informed my interpretive lens. To uphold ethical and value-conscious inquiry, the following principles were rigorously applied:

Empathy: Engaging with participants’ accounts in a non-judgmental manner, with due regard for their contextual realities.

Openness: Remaining attuned to emergent, and at times contradictory, interpretations that challenged initial assumptions.

Respect: Ensuring fidelity to participants’ voices by representing their experiences with authenticity and integrity.

Reflexivity: Maintaining a reflective research journal to systematically interrogate my own presuppositions, biases, and affective responses throughout the study.

These measures safeguarded against the undue imposition of the researcher's preconceptions, ensuring that participants' narratives remained epistemologically central.

Methodological Implications: Research Approach and Design

The interpretivist paradigm fundamentally informed this study's qualitative methodology and selection of data generation techniques. Qualitative methods such as in-depth interviews, ethnographic observations, and document analysis are particularly congruent with interpretivism, as they facilitate thick description (Geertz, 1973) of lived experiences within their naturalistic settings.

Furthermore, interpretivism privileges depth over breadth, valuing nuanced, context-sensitive understanding over statistical generalisability. This epistemological commitment aligned precisely with the study's overarching aim: to explore how teachers experience, interpret, and enact CDA in their daily practice. It also justified the adoption of a purposive sampling strategy, wherein a small, strategically selected cohort of teachers enabled intensive, contextually grounded analysis rather than superficial breadth.

By anchoring the research within this paradigm, the investigation was oriented towards an empathetic, meaning-driven, and analytically rigorous exploration of teachers' engagement with CDA. This approach ensured that the complexity, contradictions, and contextual specificities of their professional realities were rendered with both fidelity and critical acuity.

3.2 RESEARCH DESIGN

This study adopted an interpretative phenomenological research design, a qualitative approach focused on exploring and interpreting the essence of individuals' lived experiences (Smith et al., 2022). Emerging from the philosophical foundations laid by Husserl (1970) and later expanded by Heidegger (1962), phenomenology operates on the fundamental premise that genuine understanding of any phenomenon requires examination through the subjective perspectives of those who have directly encountered it (Van Manen, 2016). The approach prioritises both the 'what' of experience, the phenomena themselves and crucially the 'how' the ways in which individuals ascribe meaning to these experiences (Finlay, 2021). Within educational research, where pedagogical practices and professional decision-making are profoundly shaped by individual perceptions and contextual factors (Pring, 2015), phenomenology offers particular analytical

value. This proved especially relevant for investigating Cognitive Diagnostic Assessment (CDA) in Lesotho's primary schools, where this assessment approach remains novel and understudied (Makatjane, 2023).

The phenomenological design enabled this study to achieve several critical objectives. Firstly, it facilitated the collection of rich, first-person narratives documenting teachers' direct classroom experiences with CDA (Seidman, 2019). Secondly, it allowed for examination of the subjective meanings teachers attributed to CDA, meanings inevitably shaped by their professional identities, institutional environments, and broader socio-cultural contexts (Vagle, 2018). Thirdly, the approach proved invaluable for exploring the complex realities of how CDA is understood, implemented and potentially adapted within actual teaching conditions (Braun & Clarke, 2022). By employing phenomenology, the research moved beyond superficial accounts of CDA usage to uncover the deeper experiential, cognitive and contextual factors influencing teachers' engagement with this assessment method (Giorgi, 2009). This aligns with phenomenology's core strength, its capacity to illuminate the lived reality of phenomena rather than simply documenting their occurrence (Smith, 2017).

Methodologically, this phenomenological approach necessitated the use of in-depth, open-ended data collection techniques including semi-structured interviews, classroom observations and document analysis (Brinkmann & Kvale, 2015). These methods provided participants with the freedom to articulate their experiences in their own terms while allowing the researcher to probe for deeper insights and clarify emerging understandings (King & Horrocks, 2010). The analytical process followed established phenomenological practice by identifying both recurrent themes across participant accounts while preserving the unique qualities of individual experiences (Sanders, 2003). Central to this process was the practice of epoché or bracketing, wherein the researcher consciously acknowledged and set aside their own preconceptions about CDA to engage more authentically with participants' descriptions (Husserl, 1982). This reflexive discipline helped ensure interpretations remained grounded in participants' lived realities rather than researcher assumptions (Finlay, 2008).

The selection of phenomenology was further justified by its ontological and epistemological congruence with the study's aims. Unlike positivist approaches that seek to isolate variables and establish generalisable laws, phenomenology embraces subjectivity and contextual embeddedness as fundamental to human experience (Merleau-Ponty, 2012). Given that teachers' engagement with

CDA is inevitably mediated by their personal epistemologies, institutional constraints and cultural backgrounds (Shulman, 1987), a methodology prioritising depth and interpretive fidelity was essential (Dahlberg et al., 2008). Phenomenology's focus on lived experience proved particularly adept at revealing the tacit knowledge, practical challenges and classroom adaptations that characterise teachers' implementation of CDA (Polkinghorne, 1989). By illuminating these often-overlooked dimensions, the study contributes both to academic understanding of diagnostic assessment practices and provides practical insights for policy-makers and teacher educators working in diverse educational contexts (Creswell & Poth, 2018).

3.3 RESEARCH APPROACH

A qualitative research approach was employed in this study, as it is particularly suited to investigating complex, context-dependent phenomena that resist meaningful quantification (Idika, 2023). The research focused on teachers' subjective experiences, perceptions, and implementation practices regarding CDA aspects that are most effectively captured through narrative and descriptive methods. This methodological approach facilitated the triangulation of multiple data sources, including interviews, classroom observations, and document analysis, to develop a comprehensive understanding of the phenomenon under investigation.

3.4 STUDY AND PARTICIPANTS CONTEXT

The study was undertaken across four primary schools in Lesotho's Maseru and Botha-Bothe districts, deliberately selected to encompass both urban and peri-urban educational contexts (see Table 3.1). These locations were strategically chosen to represent diverse pedagogical environments while remaining thematically aligned with the research objectives. All participating institutions had prior involvement in formative assessment initiatives under the Lesotho Basic Education Curriculum Policy (LEBCP), ensuring some foundational awareness of assessment reform principles. This background facilitated meaningful engagement with the baseline Cognitive Diagnostic Assessment (CDA) training conducted at the study's commencement. The selected schools exhibited variation in material resources, pupil-teacher ratios, and staff experience profiles, thereby enabling examination of CDA interpretation and implementation across differing practical circumstances. Maseru, as the capital district, typifies more urbanised, relatively well-resourced educational settings, while Botha-Bothe's peri-urban context offers perspectives from environments where infrastructural and pedagogical resources may be more limited. This

deliberate urban-peri-urban dichotomy permitted a sophisticated analysis of contextual variables influencing CDA adoption.

The research focused specifically on classroom practitioners actively employing CDA in their teaching practice. Teachers were purposively selected as primary participants given their pivotal role as frontline implementers of assessment innovations, possessing invaluable practice-based knowledge regarding CDA's operational realities, challenges, and contextual modifications. Their perspectives were deemed particularly significant as they occupy the crucial nexus between policy aspirations and classroom execution. The justification for this participant focus was three-dimensional: firstly, teachers' direct classroom experience positioned them as uniquely qualified to explicate CDA's practical application and perception; secondly, as mediators of educational policy, their professional attitudes and interpretations fundamentally shape the fidelity and longevity of CDA implementation; thirdly, as catalysts of pedagogical transformation, understanding their lived experiences offers critical insights for enhancing both training provision and ongoing support mechanisms.

Participants were drawn exclusively from teachers who had completed the preliminary 12-week CDA professional development programme, ensuring baseline conceptual familiarity while still permitting investigation of the inevitable variations in interpretation and adaptation that occur when novel methodologies are introduced across distinct school environments. By anchoring the research within these carefully selected yet diverse educational settings, and by centring teachers as key informants, the study achieved a nuanced understanding of how CDA is conceptualised, enacted, and sustained within Lesotho's authentic teaching contexts.

Table 3.1

Characteristics of Participating Schools and Teachers

School Code	District	Location Type	Approx. Enrolment	Average Class Size	Resource Level	CDA Training Participation	No. of Teacher Participants	Teaching Experience Range
S1	Maseru	Urban	650	35	High – access to ICT,	Completed all 12 weeks	4	5–20 years

					printed learner materials, and teacher guides				
S2	Maseru	Urban	520	33	Moderate – some ICT access, limited teaching aids	Completed all 12 weeks	3	7–18 years	
S3	Botha-Bothe	Peri-urban	430	40	Moderate – limited ICT, reliance on blackboard and printed handouts	Completed all 12 weeks	3	6–15 years	
S4	Botha-Bothe	Peri-urban	380	42	Low – minimal ICT, shared textbooks	Completed all 12 weeks	2	8–22 years	

3.5 BASELINE ASSESSMENT

Prior to the commencement of formal data collection, a structured baseline assessment and capacity-building initiative were conducted to ensure that participating schools and teachers possessed foundational exposure to Cognitive Diagnostic Assessment (CDA). This preparatory phase was critical in cultivating participants' conceptual and practical familiarity with CDA,

thereby ensuring that the subsequent research examined informed, experiential engagements with the approach rather than abstract or hypothetical perceptions. Four primary schools two situated in the peri-urban district of Botha-Bothe and two in the urban district of Maseru were purposively selected for participation. These institutions were actively implementing formative assessment strategies as outlined in the Lesotho Basic Education Curriculum Policy (LEBCP), rendering them particularly suitable for the integration of CDA methodologies.

The baseline assessment comprised a comprehensive evaluation of existing assessment practices within each school, including brief focus group discussions with teachers to gauge their preliminary understanding of diagnostic assessment principles. Additionally, a minimum of two lessons per school were observed to identify formative assessment strategies already in use, alongside an audit of available resources, such as assessment tools, teacher guides, and ICT infrastructure. Findings from this preliminary phase revealed a spectrum of familiarity with formative assessment techniques among participants, though explicit experience with CDA-specific approaches remained limited.

Subsequent to the baseline assessment, a meticulously designed 12-week professional development programme was implemented across all participating schools. The training sought to achieve three principal objectives: to develop teachers' theoretical and practical competence in CDA, to provide hands-on experience in the design, administration, and interpretation of CDA tasks, and to facilitate the seamless integration of CDA into lesson planning and daily classroom routines. The programme was structured around two intensive three-hour sessions per week, blending theoretical instruction with practical demonstrations, collaborative activities, and reflective practice. Each weekly module was scaffolded upon preceding sessions to ensure cumulative skill development.

Teachers engaged in a variety of pedagogically rich activities, including simulated CDA exercises, collaborative development of diagnostic assessment tasks, analysis of anonymised learner responses, role-played feedback sessions, and structured peer observation cycles. Following the completion of the training, participants were supported in applying CDA within their classrooms over a sustained period of two academic terms (approximately eight months). This extended implementation phase allowed for the organic integration of CDA into regular teaching practice, enabling teachers to refine their techniques and observe learner progress systematically. Only those educators who demonstrated consistent and sustained application of CDA during this period were

invited to participate in the formal study, ensuring that the resultant data were grounded in authentic, lived experience rather than speculative or transient engagements. This rigorous preparatory framework not only enhanced the validity of the research findings but also contributed to the broader professional development of participating teachers, fostering a deeper and more sustainable understanding of CDA within Lesotho's primary education context.

Table 3.2.

Week-by-Week Training Overview

Week	Session Focus	Learning Objectives	Detailed Activities	Expected Outputs
1	Introduction to CDA	Understand CDA principles, purpose, and its role in LEBCP. Distinguish CDA from traditional assessments.	Presentation on CDA concepts; group discussion on current assessment practices; mapping CDA to LEBCP formative principles.	Teachers articulate the differences between CDA and traditional tests.
2	CDA Principles and Cognitive Attributes	Identify cognitive attributes; understand skill mastery profiles.	Attribute identification exercises; analysing curriculum content to extract skills; discussion of real learner scenarios.	Draft list of cognitive attributes for at least one subject area.
3	Designing CDA Tasks – Part 1	Translate curriculum objectives into diagnostic assessment tasks.	Workshop on task blueprints; aligning objectives with skills; peer critique of sample tasks.	Initial CDA task designs based on syllabus topics.
4	Designing CDA Tasks – Part 2	Develop tasks that reveal misconceptions.	Practice creating multi-step questions; simulate learner responses with deliberate errors; discussion of common misconceptions.	Revised tasks incorporating misconception detection elements.

5	Administering CDA – Part 1	Learn techniques for paper-based CDA administration.	Simulated test administration; observation checklists; time management strategies.	Teacher-led mock CDA session plan.
6	Administering CDA – Part 2	Use oral questioning and embedded CDA during lessons.	Role-play question-answer exchanges; observation of model lessons; collaborative planning of integrated CDA moments.	Lesson plans embedding CDA questions within teaching.
7	Analysing CDA Data – Part 1	Code learner responses to identify skill mastery levels.	Hands-on coding of anonymised scripts; group discussions on coding differences; introduction to basic CDA analysis grids.	Completed coding matrix for provided sample data.
8	Analysing CDA Data – Part 2	Interpret patterns to identify learning gaps and strengths.	Pattern analysis from coded data; plotting mastery charts; peer explanation of identified gaps.	Mastery profile charts for a sample class.
9	Planning Remediation	Link CDA findings to targeted instructional strategies.	Group design of remediation activities; role-play of small-group remedial teaching; creation of enrichment activities for high achievers.	Set of remedial and enrichment plans for a specific skill.
10	Feedback Techniques	Provide constructive, timely feedback based on CDA.	Simulation of feedback sessions; video critique of feedback styles; designing learner self-assessment tools.	Individualised feedback scripts for sample learner profiles.

11	Integrating CDA into Lesson Planning	Embed CDA into regular lesson structures.	Joint lesson plan development; peer review of integrated CDA tasks; cross-subject CDA planning exercise.	CDA-inclusive lesson plans for at least two topics.
12	Reflection and Sustainability	Reflect on CDA practice; plan for continued use.	Group reflection on training journey; identification of support structures; formation of CDA peer groups within schools.	Action plan for sustained CDA implementation.

3.6 SAMPLING TECHNIQUE AND SAMPLE

This study employed a purposive sampling strategy (Andrade, 2021; Memon & Ramayah, 2024) to deliberately select participants who could provide rich, relevant, and experience-based insights into the implementation of Cognitive Diagnostic Assessment (CDA). The selection of purposive sampling was theoretically grounded in its ability to yield information-rich cases that illuminate the phenomenon under investigation (Patton, 2015). Unlike probability sampling methods that prioritise statistical generalisability, purposive sampling aligns with qualitative research paradigms by facilitating in-depth exploration of specific experiences and contexts (Teddlie & Yu, 2007). This approach was particularly appropriate given that the research focused on teachers' lived experiences with CDA a phenomenon requiring participants with direct, practical, and sustained exposure to the approach rather than a random cross-section of the teaching population (Creswell & Poth, 2018).

The sampling frame comprised eight practising teachers, with two participants drawn from each of the four study schools. This balanced representation across the urban (Maseru) and peri-urban (Botha-Bothe) contexts served multiple methodological purposes. Firstly, it ensured geographical and contextual diversity while maintaining a sample size conducive to in-depth qualitative engagement (Baker & Edwards, 2012). Secondly, it allowed for comparative analysis of how CDA implementation varies across different educational settings (Robinson, 2014). The sample size was determined through consideration of both practical constraints and methodological requirements

for qualitative depth (Mason, 2010), with eight participants proving sufficient to reach theoretical saturation while allowing for comprehensive data collection across multiple methods.

Rigorous selection criteria were established to ensure participants could provide meaningful insights into CDA implementation. All participants had completed the 12-week CDA capacity-building programme conducted prior to this research phase, ensuring a common baseline understanding of CDA principles, task design, administration, and analysis (Brookhart, 2013). Additionally, they had implemented CDA in their classroom practice for at least two school terms post-training, enabling them to reflect on both the initial adoption phase and the process of embedding CDA into their teaching routines (Guskey, 2002). Participants also demonstrated willingness to engage in all study activities, including semi-structured interviews, classroom observations, and document sharing (lesson plans, assessment samples, learner performance profiles), as recommended by Silverman (2020) for comprehensive qualitative data collection.

This information-rich sampling approach yielded several methodological advantages. Participants provided contextually grounded accounts of CDA practice, including pedagogical adaptations made to suit specific classroom realities, implementation challenges encountered, and strategies developed to overcome them (Fullan, 2007). The inclusion of teachers from diverse school environments ranging from resource-rich urban settings to resource-constrained peri-urban contexts enabled the study to capture variations in CDA experiences shaped by factors such as infrastructure, class size, learner demographics, and institutional culture (Levin & Fullan, 2008). This deliberate diversity enhanced the study's credibility and transferability by reflecting the broader spectrum of conditions under which CDA might be implemented in Lesotho's primary schools (Lincoln & Guba, 1985).

The sampling strategy also addressed potential limitations through careful design. While purposive sampling does not claim statistical representativeness, the systematic approach to participant selection ensured the inclusion of diverse perspectives relevant to the research questions (Palinkas et al., 2015). Furthermore, the clear articulation of selection criteria and sampling rationale enhances the study's trustworthiness and allows readers to judge the potential transferability of findings to similar contexts (Tracy, 2010).

3.7 METHODS OF DATA GENERATION

To comprehensively address the study's objectives and capture the nuanced complexity of teachers' lived experiences with Cognitive Diagnostic Assessment (CDA), a multi-method qualitative data generation approach was implemented. This strategic methodological decision facilitated robust triangulation, thereby enhancing the credibility, depth, and trustworthiness of the emergent findings (Creswell & Poth, 2018). Three complementary data generation techniques were judiciously employed to illuminate different dimensions of the research phenomenon.

3.7.1 In-Depth Semi-Structured Interviews

Semi-structured interviews served as the principal method for eliciting rich, first-hand narratives regarding teachers' experiences, perceptions, and interpretations of CDA implementation. This technique was selected for its unique capacity to maintain methodological consistency through pre-determined thematic guides while simultaneously accommodating emergent, participant-driven insights through responsive probing (Lima et al., 2019; Mwita, 2022).

The interviews were specifically designed to explore four key dimensions: teachers' experiential engagement with CDA; their underlying motivations for adopting or adapting the approach; implementation challenges encountered; and the pedagogical strategies developed to navigate these challenges. Each interview session lasted approximately 45-60 minutes and was conducted face-to-face in conducive environments within school premises, facilitating both rapport establishment and the observation of meaningful non-verbal cues.

All interviews were audio-recorded following participants' informed consent and subsequently transcribed verbatim to ensure textual fidelity. Where necessary, member-checking procedures were employed to verify interpretive accuracy. The semi-structured interview guides were meticulously crafted to align with each research objective while retaining sufficient flexibility to accommodate unanticipated yet valuable participant perspectives.

Research question 1; What are the experiences of practices teachers in Lesotho classrooms regarding the implementation of Cognitive Diagnostic Assessment (CDA)?

*Can you describe your experience with implementing CDA into your teaching practices?

*What motivated you to incorporate CDA into your teaching practices?

*Can you walk me through a specific instance where you used CDA to assess student learning?

*What challenges, if any, did you encounter while implementing CDA in your classroom?

*How do you perceive the impact of CDA on your teaching practices and student learning outcomes?

*What strategies have you found effective in integrating CDA into your instructional planning?

Question 2; How do practicing teachers perceive the effectiveness and utility of CDA in improving their assessment practices and supporting student learning in Lesotho?

*How do you perceive the effectiveness of CDA compared to traditional assessment methods?

* In what ways do you believe CDA enhances your assessment practices?

*Can you provide examples of how CDA has helped you identify specific areas of student strengths and weaknesses?

*How do you think CDA contributes to promoting deeper student understanding of concepts?

*What benefits do you see in using CDA for informing your instructional decisions and interventions?

*Have you observed any challenges or limitations in using CDA to support student learning outcomes?

QUESTION 3a) What are the main challenges faced by practicing teachers in Lesotho classrooms when integrating CDA into their classrooms?

*What are the primary challenges you face when integrating CDA into your teaching practices?

*How do you navigate resource constraints or other logical challenges associated with implementing CDA?

*Have you encountered any resistance or skepticism from colleagues or administrators regarding the use of CDA?

QUESTION 3b) What strategies do they employ to address these challenges?

*What strategies have you found effective in overcoming challenges related to implementing CDA?

*How do you ensure that CDA aligns with the curriculum and learning objectives in your classroom?

*In what ways do you collaborate with other teachers or educational stakeholders to support the effective implementation of CDA?

3.7.2. Classroom Observations

The observational component of this study enabled direct examination of CDA implementation within authentic pedagogical contexts, affording the researcher first-hand insight into real-time teacher-student interactions, diagnostic assessment techniques, and formative feedback processes. This methodological approach yielded significant contextual depth while serving as a crucial mechanism for triangulating and substantiating interview-derived data (Satapathy, 2023). The naturalistic observation paradigm facilitated the documentation of both intended and emergent assessment practices, thereby capturing the dynamic interplay between CDA's theoretical framework and its practical instantiation in classroom settings.

Purpose:

- To examine the practical enactment of Cognitive Diagnostic Assessment (CDA) principles within authentic classroom environments

To document:

- The nature and structure of CDA-aligned tasks
- Questioning techniques and cognitive scaffolding approaches
- Differentiation strategies for diverse learners
- Feedback mechanisms and their implementation

Procedure:

- Conducted non-participant observations during scheduled lessons incorporating CDA activities
- Maintained researcher objectivity while allowing naturalistic observation of pedagogical practices
- Scheduled across multiple sessions to capture routine implementation rather than performative demonstrations

Data Recording:

- Comprehensive field notes captured:

Descriptive elements:

- Classroom spatial organisation
- Teaching aids and resource utilisation
- Observable teacher-student interactions
- Student engagement patterns

Reflective elements:

- Researcher's analytical impressions
- Emerging pedagogical patterns
- Noteworthy deviations from expected practices
- Systematic integration with interview transcripts during subsequent thematic analysis

Methodological Value:

- Provided triangulation between:
 - Teachers' self-reported practices (interview data)
 - Observed classroom implementation

Revealed:

- Congruities between espoused and enacted practices
- Significant practice-theory discrepancies
- Contextual factors influencing CDA implementation fidelity
- Enhanced study's ecological validity through direct practice observation

3.7.3. Document Review

The study incorporated document analysis as a substantive methodological component, providing material evidence of Cognitive Diagnostic Assessment (CDA) implementation through examination of pedagogical artefacts (Regina de Andrade et al., 2018). This analytical approach examined multiple documentary sources:

- **Lesson plans** detailing instructional sequencing

- **CDA task sheets** demonstrating assessment design
- **Marking schemes** revealing evaluation criteria
- **Learner performance profiles** tracking developmental progression
- **Anonymised learner work samples** exhibiting diagnostic application

The analysis specifically sought to establish the degree to which CDA principles manifested within planning documentation, assessment instruments, and tangible learner outputs. Examination focused on identifying diagnostic characteristics including:

- Explicit articulation of learning objectives
- Systematic error pattern analysis
- Differentiated feedback mechanisms
- Planned remediation strategies

This documentary review constituted a critical validation mechanism, enabling cross-verification between:

1. Teachers' reported practices (interview data)
2. Observed classroom implementation
3. Material teaching artefacts

Through this tripartite comparison, the analysis significantly enhanced the internal validity of research findings by establishing evidentiary consistency across multiple data sources. The approach provided concrete substantiation of how CDA principles were operationalised within the study's educational contexts, while simultaneously revealing potential disjunctures between pedagogical intention and practical realisation.

The documentary analysis yielded several key methodological contributions to this study, foremost among them being the provision of objective verification of CDA implementation through systematic examination of pedagogical artefacts (Regina de Andrade et al., 2018). This approach revealed previously tacit pedagogical decision-making processes embedded within lesson plans and assessment materials (Polanyi, 1966), while establishing concrete material evidence of diagnostic practice through analysis of learner work samples and performance profiles (Brookhart, 2013). Crucially, the incorporation of document analysis strengthened analytical triangulation by enabling cross-validation between teachers' self-reported practices, observed classroom behaviours, and tangible teaching artefacts (Denzin, 2017), thereby enhancing the study's internal

validity and providing a more comprehensive understanding of how CDA principles were operationalised in practice (Merriam & Tisdell, 2016). The methodological approach not only substantiated findings from other data sources but also uncovered subtle disjunctures between pedagogical intention and practical realisation that might otherwise have remained obscured (Silverman, 2020).

RESEARCH TRUSTWORTHINESS

Trustworthiness, constituting the methodological rigour of qualitative inquiry, denotes the degree to which research findings demonstrate credibility, authenticity, and fidelity to participants' lived realities (Polit & Beck, 2014). This conceptual framework serves to validate that investigative processes and resultant interpretations maintain robustness, transparency, and freedom from unwarranted partiality, thereby fortifying scholarly confidence in the study's epistemological contributions. The present research operationalised trustworthiness through Lincoln and Guba's (1985) seminal criteria of transferability, confirmability, dependability, and credibility, with each dimension being systematically addressed through tailored methodological strategies as subsequently delineated.

3.8.1. Transferability

Transferability, denoting the extent to which research findings possess applicability beyond their immediate context to analogous settings with comparable conditions (Kakar et al., 2023), was systematically addressed in this study through several deliberate methodological strategies: thick, rich descriptions of the research context were provided, encompassing detailed accounts of the geographical locations, socio-economic environments, and institutional infrastructures characterising both the Maseru and Botha-Bothe districts; participant profiles were meticulously documented, including relevant professional characteristics such as years of teaching experience, subject specialisations, and prior engagement with Cognitive Diagnostic Assessment (CDA) methodologies; and comprehensive procedural accounts were furnished regarding the study's implementation, thereby equipping readers with the necessary contextual and methodological information to make informed judgements about the potential applicability of the findings to their own educational settings.

3.8.2. Confirmability

Confirmability, which pertains to the neutrality and objectivity of research findings by ensuring they accurately reflect participants' perspectives rather than being unduly influenced by researcher

bias (Kocaman, 2024), was rigorously addressed in this study through multiple verification strategies: researcher reflexivity was maintained through systematic journaling to document and critically examine my own assumptions, methodological decisions, emotional responses, and potential biases throughout the research process; peer debriefing was conducted with an experienced qualitative researcher who independently reviewed my analytical interpretations, coding frameworks, and emergent themes to verify their grounding in the empirical data; and all substantive analytical claims were substantiated through direct evidentiary support from participant quotations and methodological triangulation across interviews, observations, and documentary sources, thereby ensuring the findings remained firmly anchored in the collected data rather than subjective interpretation.

3.8.3. Dependability

Dependability, denoting the consistency and temporal stability of research findings across different investigative contexts (Tariq, 2025), was methodically addressed through three principal strategies: comprehensive audit trails were meticulously maintained, comprising exhaustive documentation of all methodological procedures, data collection protocols, analytical frameworks, and thematic development processes to ensure complete transparency; peer debriefing sessions were conducted with academic colleagues and supervisory panels, who critically examined the analytical progression and interpretive decisions to verify methodological rigour and minimise subjective bias; and systematic recording of all procedural adaptations and analytical judgements was implemented, thereby establishing a replicable research architecture that facilitates future scholarly examination of comparable phenomena while maintaining rigorous standards of methodological transparency.

3.8.4. Credibility

Credibility, constituting the qualitative equivalent of internal validity, denotes the degree to which research findings authentically reflect participants' lived experiences and perceptions of reality (Lincoln & Guba, 1985, as cited in Abidin et al., 2024). This study employed three robust strategies to enhance credibility: firstly, member checking was systematically implemented following Birt et al.'s (2016) protocols, whereby participants actively verified both their interview transcripts and preliminary analytical interpretations through an iterative process that ensured the faithful representation of their intended meanings and experiential accounts; secondly, methodological triangulation was rigorously applied, with emerging patterns cross-validated through multiple

evidentiary streams - including semi-structured interviews, naturalistic classroom observations, and comprehensive document analysis - thereby mitigating the limitations inherent in single-source data while substantiating the robustness of thematic findings (Tariq, 2025); thirdly, prolonged engagement was strategically maintained across all research sites, facilitating both the development of meaningful rapport with participants and the acquisition of nuanced, contextually-grounded insights into the complex interplay between institutional environments, pedagogical practices, and teachers' evolving engagement with Cognitive Diagnostic Assessment (CDA) methodologies.

3.9 METHOD OF DATA ANALYSIS

This study adopted an inductive thematic analysis approach, rigorously following the six-phase analytical framework developed by Braun and Clarke (2006, 2009). The selection of thematic analysis was methodologically justified by its inherent flexibility combined with systematic rigour, characteristics that rendered it particularly appropriate for identifying, examining, and interpreting patterns of meaning within qualitative datasets while maintaining alignment with the study's interpretivist-phenomenological orientation. The inductive approach was deliberately chosen to ensure that emerging themes remained firmly grounded in participants' own accounts, thereby avoiding the imposition of predetermined theoretical categories and preserving the authenticity of lived experiences.

All qualitative data - including verbatim interview transcripts, detailed classroom observation field notes, and comprehensive document review records - were systematically imported into ATLAS.ti (version 24.1.0) to facilitate robust data management and analysis. The software platform enabled efficient coding procedures, visual mapping of conceptual relationships between emerging codes, and systematic tracking of analytical memos throughout the interpretive process. This digital analytical environment not only enhanced the efficiency of data handling but also ensured complete transparency and auditability of the entire analytical process, thereby supporting the study's commitment to methodological rigour while accommodating the complexity inherent in phenomenological qualitative data.

Thematic Analysis Process

The analytical process rigorously followed Braun and Clarke's (2006) six-phase framework, beginning with comprehensive familiarisation with the dataset through repeated reading of interview transcripts and observation notes, coupled with revisiting audio recordings during

transcription to capture paralinguistic features including tone, pauses, and emphasis, while contemporaneous analytic memos documented preliminary impressions and emerging areas of significance. The subsequent coding phase employed both line-by-line examination and holistic consideration of each data segment, generating descriptive codes that captured both semantic content and latent meanings relevant to teachers' experiences, perceptions, implementation strategies, and challenges regarding CDA. These codes were systematically examined for conceptual patterns and relationships, with ATLAS.ti's visual mapping tools facilitating the organisation of related codes into candidate themes such as "teachers' experiences with implementing CDA in classroom practice, Teachers' motivations for incorporating CDA into their teaching practice, Specific integration of CDA to diagnose and address specific learning challenges, Barriers to effective implementation of CDA in the classroom, Positive transformations in teaching and learning through CDA, Effective strategies for integrating CDA into instructional planning, Perception of CDA as a superior alternative to traditional methods, CDA as a transformative tool for responsive and informed assessment practices, Using CDA to reveal learner-specific cognitive patterns and instructional needs, CDA as a catalyst for deep conceptual understanding and learner growth, Benefits of CDA for informed, responsive instruction, Observed any challenges in using CDA to support student learning outcomes, Primary challenges in integrating CDA into classroom practice, Teachers adaptive strategies for navigating resource and logical constraints, Resistance from colleagues or administrators regarding the use of CDA, Adaptive strategies for overcoming challenges in implementing CDA, Aligning CDA with curriculum and instructional objective and Collaborative practices to enhance the implementation of CDA ", while maintaining constant comparison across the dataset. The iterative theme review process evaluated each candidate theme for internal coherence and external distinction, resulting in strategic merging or subdivision of themes where analytical precision required, followed by precise definition and nomenclature development that balanced conceptual breadth with nuanced specificity through carefully delineated sub-themes where appropriate. The final analytical phase synthesised these refined themes into a scholarly narrative that integrated thick description with illustrative verbatim extracts, constructing a comprehensive thematic map that demonstrated both the individual significance and interconnected relationships between themes, thereby providing robust answers to the research questions while offering nuanced illumination of CDA as a lived pedagogical phenomenon in Lesotho's primary education context.

3.10 ETHICAL CONSIDERATIONS

Ethical considerations constitute a fundamental component of rigorous qualitative research, particularly when investigating sensitive, contextually embedded phenomena involving human participants (British Educational Research Association [BERA], 2018; Hammersley & Traianou, 2021). In accordance with both institutional protocols and contemporary ethical guidelines for educational research, this study implemented comprehensive safeguards to protect participants' rights and wellbeing throughout the investigation. Institutional approval was secured through formal authorisation from the Dean of the Faculty of Education at the National University of Lesotho, confirming the study's alignment with established ethical standards for educational research (Universities UK, 2022). Prior to data collection, written permission was obtained from school principals as institutional gatekeepers, with detailed explanations provided regarding the study's academic purpose, methodological procedures, and anticipated contributions to pedagogical knowledge (Cohen et al., 2023).

Participant consent was meticulously obtained through a two-stage process: all teachers received comprehensive information sheets outlining the research objectives, methodological procedures, potential benefits, and conceivable risks, followed by written confirmation of their voluntary participation (BERA, 2018). Rigorous confidentiality protocols were implemented, including secure digital storage of all research data in encrypted, password-protected systems accessible exclusively to the principal investigator, alongside the systematic use of pseudonyms to ensure participant anonymity in all research outputs (Saunders et al., 2021). The voluntary nature of participation was emphasised throughout the research process, with explicit assurances given regarding participants' unconditional right to withdraw without consequence at any stage (Hammersley & Traianou, 2021).

Methodological sensitivity to contextual power dynamics and cultural norms was maintained through reflexive practice, with particular attention paid to creating equitable researcher-participant relationships and accommodating individual comfort levels during data collection (Cohen et al., 2023). The researcher adopted a position of professional empathy throughout all interactions, employing tactful communication strategies and respecting participants' autonomy regarding question responses, thereby upholding the ethical principles of respect, beneficence, and justice that underpin quality educational research (BERA, 2018; Universities UK, 2022).

Summary

This chapter has systematically delineated the methodological framework guiding the present investigation, articulating the philosophical underpinnings of the interpretivist-phenomenological paradigm that informed the study's design and execution. The comprehensive exposition has encompassed the research context, purposive sampling strategy, multi-method qualitative data generation techniques, rigorous analytical procedures, and robust measures implemented to ensure methodological trustworthiness and ethical integrity. These carefully considered methodological decisions were conceptually and operationally aligned to achieve the study's fundamental objective: to elucidate the nuanced, contextually embedded lived experiences of primary school teachers implementing Cognitive Diagnostic Assessment (CDA) within Lesotho's distinctive educational landscape. The methodological architecture was deliberately constructed to facilitate the emergence of authentic, practice-based insights while maintaining the highest standards of academic rigour appropriate for a masters research. Building upon this methodological foundation, Chapter 4 will present the empirical findings that emerged from this systematic investigative process. The results will be organised thematically in direct correspondence with the study's guiding research questions, offering a coherent yet nuanced representation of teachers' experiential realities with CDA implementation. The forthcoming analysis will integrate rich qualitative evidence to construct a comprehensive understanding of how this diagnostic assessment approach is interpreted, adapted, and operationalised within Lesotho's primary education context, while simultaneously identifying both the transformative potentials and implementation challenges inherent in this pedagogical innovation.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

1.0 INTRODUCTION

This chapter presents empirical findings and critically analyses the empirical findings of the study, which investigated the lived experiences of primary school teachers implementing Cognitive Diagnostic Assessment (CDA) in Lesotho. The data were analysed using ATLAS.ti (version 24.1.0), employing an inductive thematic analysis framework (Braun & Clarke, 2006, 2009). Grounded in an interpretivist paradigm, the analysis sought to elucidate the subjective meanings and multifaceted perspectives of teachers concerning CDA integration within their pedagogical practice. To ensure methodological robustness, a multi-source data triangulation approach was adopted, incorporating semi-structured interviews, classroom observations, and document analysis, thereby enhancing the credibility, dependability, and interpretive depth of the findings. The findings are presented according to the research questions. For each research question, emerging themes are described and supported by participants' responses.

To contextualise the findings, Table 4.1 provides a demographic overview of the study participants, including pseudonyms (assigned to preserve confidentiality), school locations, and relevant background information.

Table 4.1. Participant Information

S/N	ID	Name of the teacher	School Location
1	PARTICIPANT 1_PERI-URBAN(P1PU)	TEACHER D (TD)	PERI-URBAN
2	PARTICIPANT 2_URBAN(P2U)	TEACHER G (TG)	URBAN
3	PARTICIPANT 3_URBAN(P3U)	TEACHER H (TH)	URBAN
4	PARTICIPANT 4_URBAN(P4U)	TEACHER E (TE)	URBAN
5	PARTICIPANT 5_URBAN(P5U)	TEACHER F (TF)	URBAN
6	PARTICIPANT 6_PERI-URBAN(P6PU)	TEACHER C (TC)	PERI-URBAN
7	PARTICIPANT 7_PERI-URBAN(P7PU)	TEACHER B (TB)	PERI-URBAN

8	PARTICIPANT 8_PERI- URBAN(P8PU)	TEACHER A (TA)	PERI-URBAN
---	------------------------------------	----------------	------------

Research question 1: What are the experiences of practicing teachers regarding the implementation of CDA classrooms?

TEACHERS’ EXPERIENCES WITH IMPLEMENTING CDA IN CLASSROOM PRACTICE

This theme examines educators’ application of Classroom Diagnostic Assessment (CDA) to refine and adapt their pedagogical strategies. Teachers’ reflections indicate a transition towards a more reflective, responsive, and learner-centred instructional approach. Two principal sub-themes emerged: *Enhanced Awareness of Learners’ Strengths and Gaps*, which underscores CDA’s role in elucidating individual learning profiles, and *Individualised Instruction and Learner-Centred Adaptation*, which delineates how teachers leverage these insights to tailor instruction, deliver targeted support, and differentiate tasks in alignment with learners’ specific needs and competencies. Collectively, these sub-themes underscore CDA’s transformative potential in augmenting instructional efficacy and learner outcomes. Figure 4.1 illustrates the overarching theme (teachers’ experiences with CDA implementation) and its constituent sub-themes.

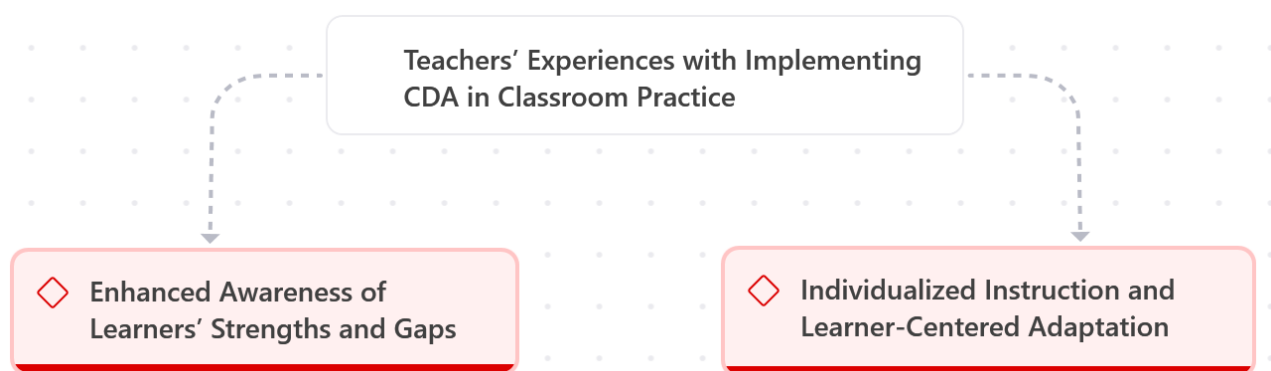


Figure 4.1. Teachers’ Experiences with Implementing CDA in Classroom Practice

Enhanced Awareness of Learners’ Strengths and Gaps

This theme demonstrates how the implementation of Cognitive Diagnostic Assessment (CDA) has enhanced teachers' comprehension of learners' individual competencies, educational requirements, and areas necessitating intervention. By employing CDA, educators are more adept at individualising instruction, thereby transcending conventional uniform approaches. As one participant articulated, *"I have realized that CDA allows me to accommodate learners as individuals with their differences in teaching and learning"* (P6PU), reflecting a transition towards more inclusive pedagogy. Such personalisation ensures that *"every learner [has] a chance to learn in such a manner that satisfies their needs"* (P6PU). Teachers additionally perceived the process as professionally gratifying, as it facilitated more precise discernment of pupils' knowledge states and cognitive preferences; one remarked, *"It was enjoyable because it helped me to know what my learners know and what they do not know, and how they learn best"* (P7PU). These diagnostic insights enabled educators to tailor instruction more effectively, exemplified by the observation: *"Implementing CDA in my teaching practices has helped me to cater to all my learners' needs in my classroom"* (P8PU). Cumulatively, these accounts affirm CDA's role in fortifying pedagogical responsiveness to learner diversity.

To further contextualise these findings, Figure 4.2 delineates the sub-theme (*Enhanced Awareness of Learners' Strengths and Gaps*), supplemented by participants' perspectives.

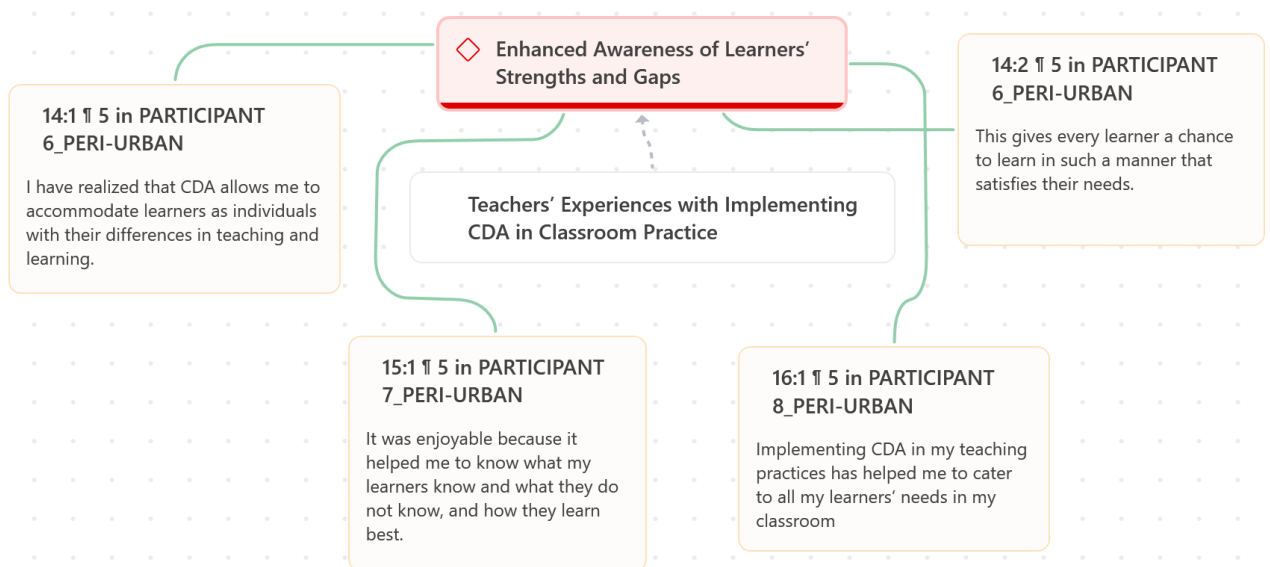


Figure 4.2. Enhanced Awareness of Learners' Strengths and Gaps

Individualised Instruction and Learner-Centered Adaptation

This theme elucidates how CDA has enabled teachers to customise their pedagogical approaches according to distinct learner profiles. Through continuous diagnostic evaluation, teachers identified both learning deficiencies and areas of proficiency, facilitating more precise intervention and academic enrichment. As one practitioner observed, *"But it helped me a lot. Since I managed to help every student understand and acquire the skills that I wanted them to master"* (P1PU), demonstrating CDA's role in fostering inclusive instructional practices.

This individualised monitoring permitted teachers to pinpoint specific learning requirements, exemplified by the reflection: *"I had to attend to every student in my class. That made me see where they were seeking help, and where they were capable"* (P1PU). By comprehending students' differential comprehension levels, teachers could *"plan [their] lessons in a way that addresses individual learners' needs"* (P3U), thereby ensuring universal skill acquisition.

The diagnostic process informed both resource selection and remedial strategies, as evidenced: *"CDA assisted me in diagnosing learning gaps in every learner I teach... and have remedial classes for slow learners to close such gaps"* (P5U). Concurrently, advanced learners received appropriate challenges through enrichment activities: *"those who excel I prepare extra work for them, so that they don't get bored or have a chance to idle"* (P5U).

The transformative impact of such tailored planning was further affirmed: *"Knowing where each learner struggles has helped to adjust my lessons so that where remediation is needed, I can be able to do that"* (P8PU). These collective experiences underscore CDA's capacity to cultivate an adaptive, differentiated instructional paradigm that acknowledges heterogeneous learning trajectories.

Figure 4.3 presents the emergent sub-theme (*Individualised Instruction and Learner-Centred Adaptation*), accompanied by teachers' perspectives on CDA-facilitated personalised pedagogy.

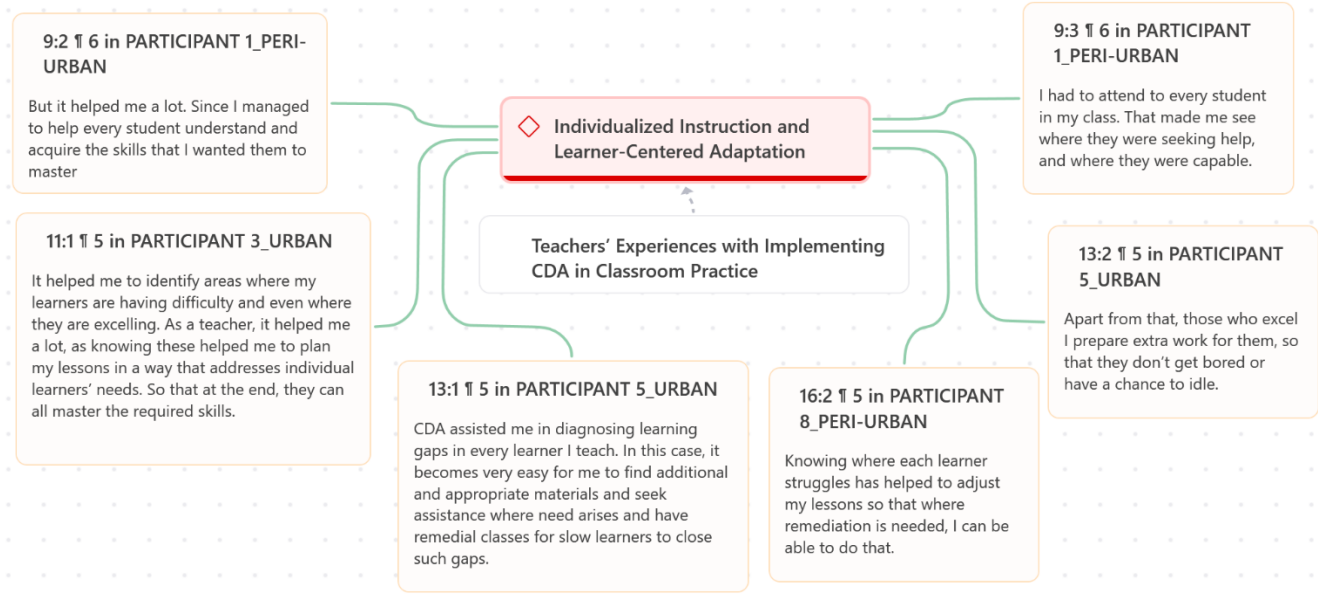


Figure 4. 3. Individualized Instruction and Learner-Centred Adaptation

TEACHERS' MOTIVATIONS FOR INCORPORATING CDA INTO THEIR TEACHING PRACTICES

The theme examining teachers' motivations for incorporating Cognitive Diagnostic Assessment (CDA) into their pedagogical practice reveals teachers' substantive rationale for adopting this assessment approach. Analysis demonstrates that teachers implemented CDA not as a perfunctory compliance with assessment mandates, but rather as a purposeful strategy to enhance instructional quality and learning outcomes. Three interrelated motivational factors emerged from the data. Primarily, teachers perceived CDA's inherent alignment with both national curriculum objectives and formative assessment principles, facilitating its organic integration into established classroom practices. Furthermore, educators expressed a professional commitment to diagnosing individual learners' specific difficulties and providing tailored instructional support to address knowledge gaps - a motivation reflecting their dedication to differentiated pedagogy. Additionally, teachers reported observable improvements in learner engagement, classroom participation, and conceptual mastery attributable to CDA implementation, noting its capacity to stimulate student motivation and deepen understanding. These findings collectively indicate that teachers' adoption of CDA stemmed from both systemic pedagogical considerations and a fundamental orientation toward learner-centered instruction. The complete motivational framework is presented visually in Figure 4.4, which delineates all emergent sub-themes and their interrelationships.

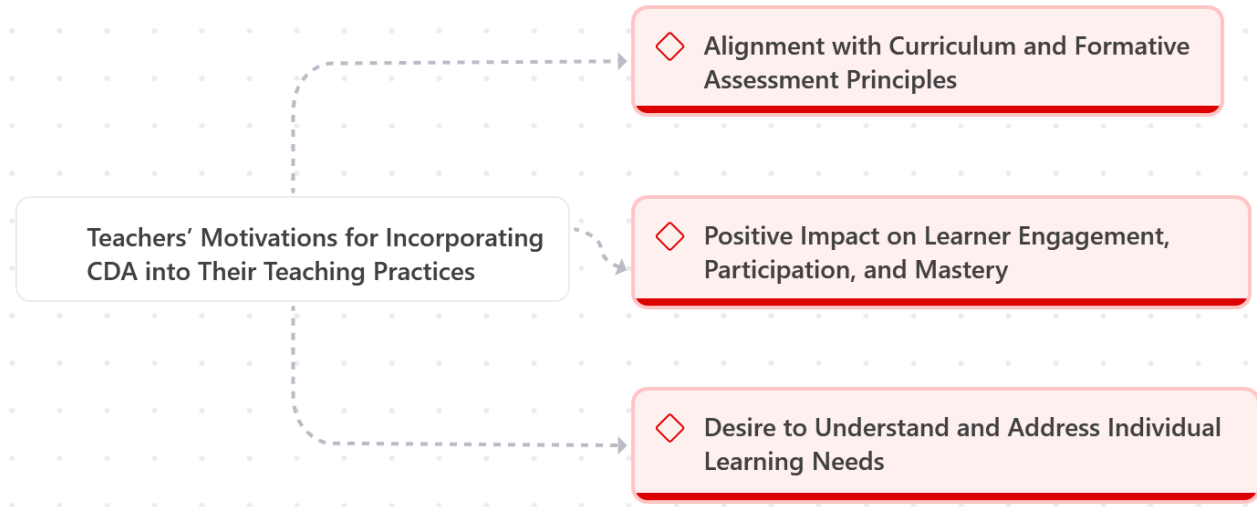


Figure 4.4 Teachers' motivation for incorporating CDA into their teaching practices

Alignment with Curriculum and Formative Assessment Principles

This theme elucidates how educators perceive Classroom Diagnostic Assessment (CDA) as fundamentally congruent with both the national curriculum and its formative assessment priorities. Practitioners identified CDA as pedagogically synergistic with curricular objectives through its emphasis on continuous, process-oriented evaluation that directly informs instructional practice. As one teacher articulated, *"CDA works compatibly with the curriculum used in Lesotho schools because it works with formative assessment, which is also part of the curriculum. Formative assessment is diagnostic"* (P5U). This conceptual alignment enables immediate pedagogical interventions, evidenced by another participant's explanation: *"After all, it is used daily and during the process of learning because it is an assessment for learning. Here I get a chance to assist a learner immediately whenever I see the problem, immediate feedback"* (P5U).

Furthermore, teachers conceptualised CDA as an instrumental mechanism for implementing differentiated instruction tailored to individual learner progression. One educator noted, *"After realizing that CDA can help me to pinpoint what my learners are capable of/and not capable of. Through CDA the differentiated learning can also be effective in all learning areas"* (P6PU). These perspectives collectively demonstrate that CDA's formative characteristics not only align with existing curricular frameworks but significantly enhance pedagogical responsiveness and efficacy.

For further clarification, Figure 4.5 presents two key sub-themes: alignment with the curriculum and formative practices, and positive impact on learners' engagement, participation, and mastery.

Teachers' responses behind their motivation are also illustrated.

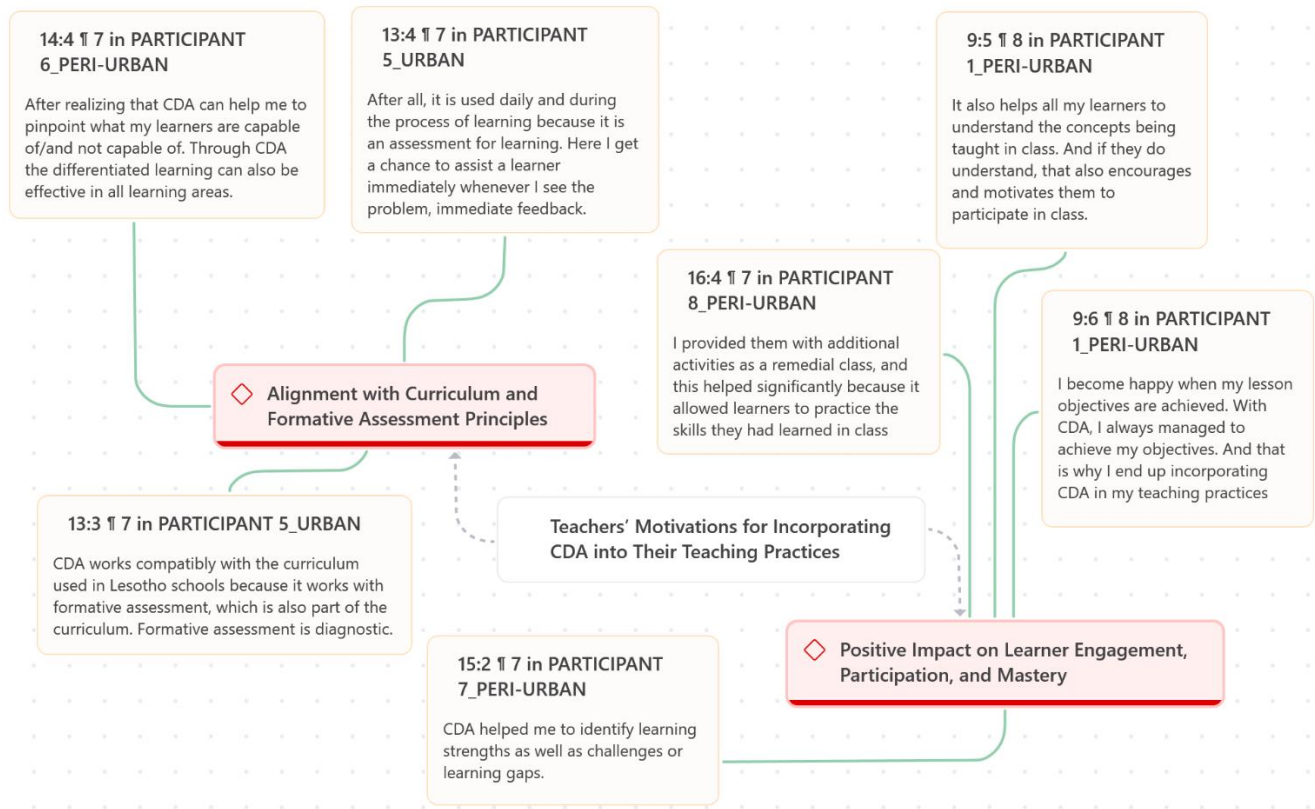


Figure 4.5 Teachers' Motivation for incorporating CDA into their teaching practices

Positive Impact on Learner Engagement, Participation, and Mastery

The theme highlights how teachers perceived CDA as a tool that fosters meaningful learner involvement and improves learning outcomes. One teacher shared that *“It also helps all my learners to understand the concepts being taught in class. And if they do understand, that also encourages and motivates them to participate in class”* (P1PU), showing that comprehension and engagement are interlinked. This positive cycle of understanding leading to participation and motivation was further reinforced by the satisfaction teachers derived from achieving their instructional goals: *“With CDA, I always managed to achieve my objectives. And that is why I end up incorporating CDA in my teaching practices”* (P1PU). Moreover, CDA enabled teachers to recognise both learners' strengths and areas for growth, which contributed to more tailored and effective teaching: *“CDA helped me to identify learning strengths as well as challenges or learning gaps”* (P7PU). This diagnostic insight paved the way for targeted remediation, as noted by a teacher who stated, *“I provided them with additional activities as a remedial class, and this*

helped significantly because it allowed learners to practice the skills they had learned in class” (P8PU). Collectively, these insights suggest that CDA not only deepened teachers’ understanding of student progress but also enhanced learners’ motivation and mastery through responsive and supportive instruction.

Desire to Understand and Address Individual Learning Needs

This theme demonstrates that teachers' adoption of Cognitive Diagnostic Assessment (CDA) stemmed principally from a profound pedagogical commitment to addressing individual learners' distinct educational trajectories. Practitioners articulated a professional imperative to transcend superficial evaluation and instead diagnose the root causes of academic difficulties, as exemplified by one teacher's reflection: *"Every learner deserves to acquire fully the skills taught. So, while testing the class, most underperformed. So, this haunted me, hence I needed to know individual ability on the skills presented to them"* (P2U).

The diagnostic capacity of CDA proved particularly valuable in identifying not merely areas of struggle but, crucially, *"to identify the learning gaps for individual learners and to identify possible causes of those gaps"* (P3U). This granular understanding facilitated precisely targeted pedagogical interventions, with one teacher observing: *"When I know where the possible cause is, I will be able to focus on areas where learners need help the most"* (P3U). Several participants contrasted this diagnostic approach with conventional assessment limitations, noting that *"CDA helped me see why and how to support them more effectively"* (P4U).

The personal significance of this diagnostic capability emerged strongly, with one teacher emphasising: *"Being able to help an individual learner who did not catch up is what has motivated me to incorporate CDA in my teaching practice"* (P8PU). Collectively, these accounts reveal a shared professional ethos centred on leveraging CDA's diagnostic potential to personalise instruction according to learners' specific needs.

Figure 4.6 further illustrates this motivational dimension through the sub-theme *desire to understand and address learners' needs*, demonstrating its significance in teachers' adoption of CDA methodologies.

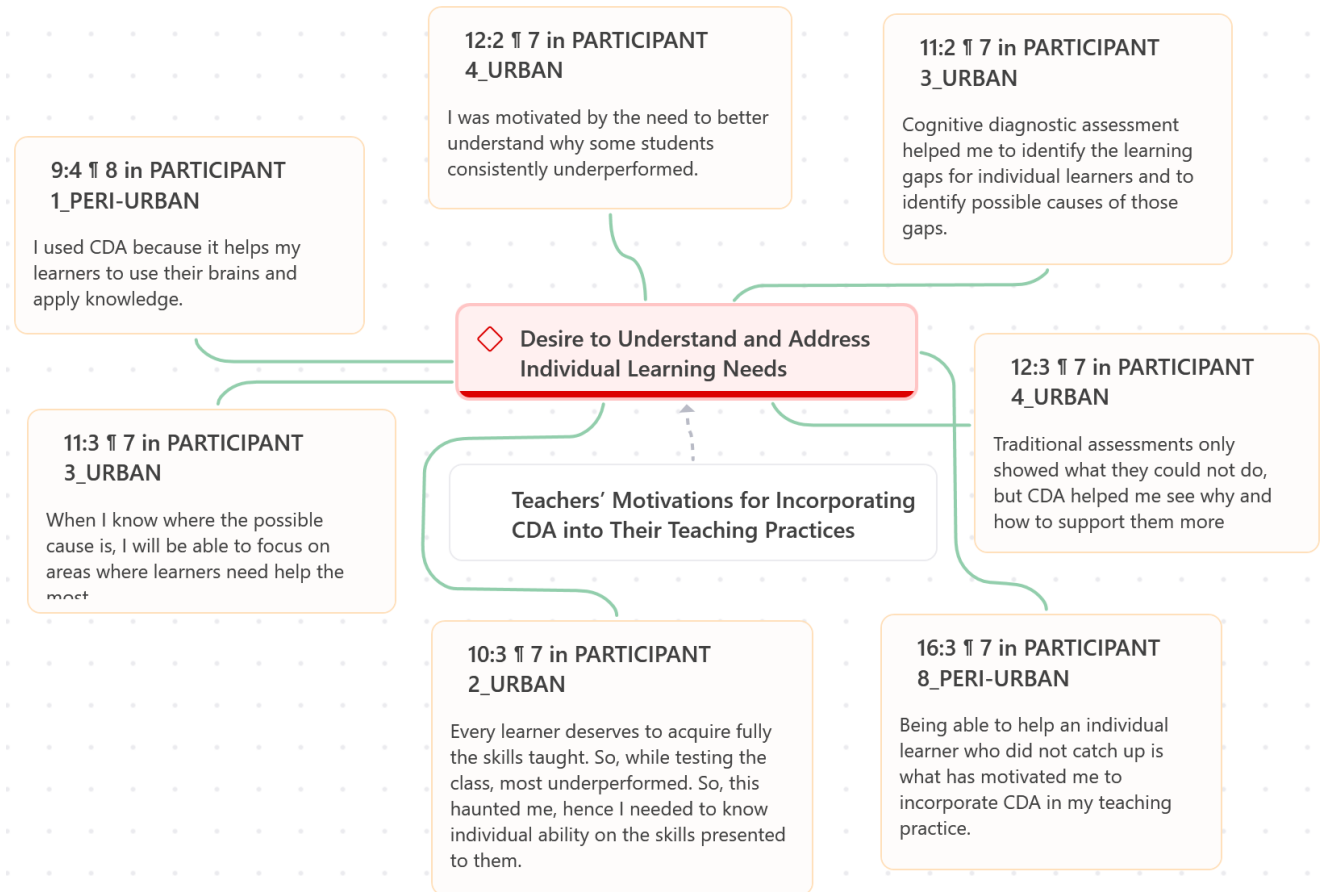


Figure 4. 6 *Desire to understand and address individual learning needs*

SPECIFIC INTEGRATION OF CDA TO DIAGNOSE AND ADDRESS SPECIFIC LEARNING CHALLENGES

This theme demonstrates how teachers systematically employ Cognitive Diagnostic Assessment (CDA) as a targeted mechanism for identifying and addressing subject-specific learning difficulties with precision. Moving beyond conventional assessment paradigms, teachers utilise CDA's diagnostic capacity to reveal discrete conceptual and skill-based deficiencies, thereby enabling precisely tailored pedagogical interventions. The findings reveal CDA's application extends significantly beyond general classroom monitoring, serving as a specialised diagnostic tool for critical academic domains including reading fluency, mathematical reasoning and linguistic development.

Two critical dimensions emerge from this analysis, both highlighting CDA's transformative role in contemporary pedagogy. The first dimension concerns its application in detecting fundamental

literacy and numeracy gaps that often underlie broader learning challenges. The second dimension focuses on how diagnostic insights inform the development of strategic remedial interventions, frequently implemented through differentiated group work. Together, these aspects illustrate CDA's capacity to foster a responsive, learner-centred instructional approach that prioritises individual academic needs over standardised teaching methods.

For comprehensive visual representation, Figure 4.7 delineates these interconnected dimensions, demonstrating how teachers operationalise CDA to diagnose and subsequently address specific learning obstacles. The schematic presentation underscores the assessment tool's dual function as both diagnostic instrument and pedagogical guide, reinforcing its value in contemporary educational practice. This analytical framework ultimately positions CDA not merely as an assessment methodology but as an integral component of differentiated instruction and targeted learning support.

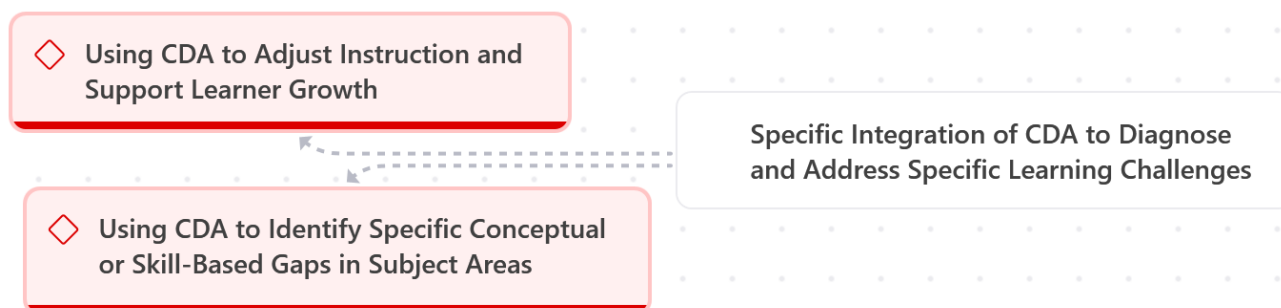


Figure 4. 7 Specific integration of CDA to diagnose and address specific learning challenges

Using CDA to Adjust Instruction and Support Learner Growth

This theme illuminates how teachers systematically employ Cognitive Diagnostic Assessment (CDA) as a dynamic pedagogical tool to identify specific learning deficiencies and subsequently adapt instructional strategies. The findings reveal that teachers utilise CDA not merely as a retrospective evaluative mechanism, but as an integral component of formative practice that informs real-time pedagogical decision-making. Empirical evidence demonstrates its application across diverse disciplinary contexts, with practitioners consistently reporting enhanced capacity to diagnose and address individual learning challenges during instructional delivery.

The data illustrate several paradigmatic instances of CDA's operationalisation in classroom practice. In the scientific domain, one practitioner recounted a soil composition lesson where

diagnostic assessment revealed particular difficulties with quantitative measurement: *"some learners could not find the exact length of this organic matter"* (P3U). This immediate identification of conceptual obstacles enabled timely instructional modifications to scaffold understanding. Similarly, in foundational literacy instruction, another educator employed CDA to monitor phonemic awareness, implementing targeted interventions for struggling learners: *"I assisted those who were not able to remember by teaching them to say the letters"* (P5U).

More sophisticated applications emerged in learner-directed scientific inquiry, where diagnostic assessment occurred organically through observation of investigative processes and presentations. As one teacher reflected: *"Their different topics and conduct of the investigation made me aware of what the learners know and can do and how deeply each of them understands their topics, as well as their struggles"* (P6PU). This exemplifies CDA's capacity to reveal both surface-level competencies and deeper conceptual understandings through authentic learning activities.

Collectively, these practitioner accounts position CDA as a multifaceted diagnostic instrument that transcends conventional assessment paradigms. Its implementation facilitates a responsive teaching methodology wherein instructional decisions are continuously informed by empirical evidence of learner understanding. The operational mechanisms through which teachers employ CDA to modify instruction and promote academic progression are further explicated in Figure 4.8, which provides a systematic representation of these adaptive pedagogical practices.

This analysis ultimately underscores CDA's transformative potential in cultivating a data-informed, learner-centred instructional environment where pedagogical strategies evolve in direct response to diagnostic insights, thereby optimising educational outcomes. The findings affirm that when properly operationalised, CDA transcends its assessment function to become an indispensable component of differentiated and responsive teaching practice.

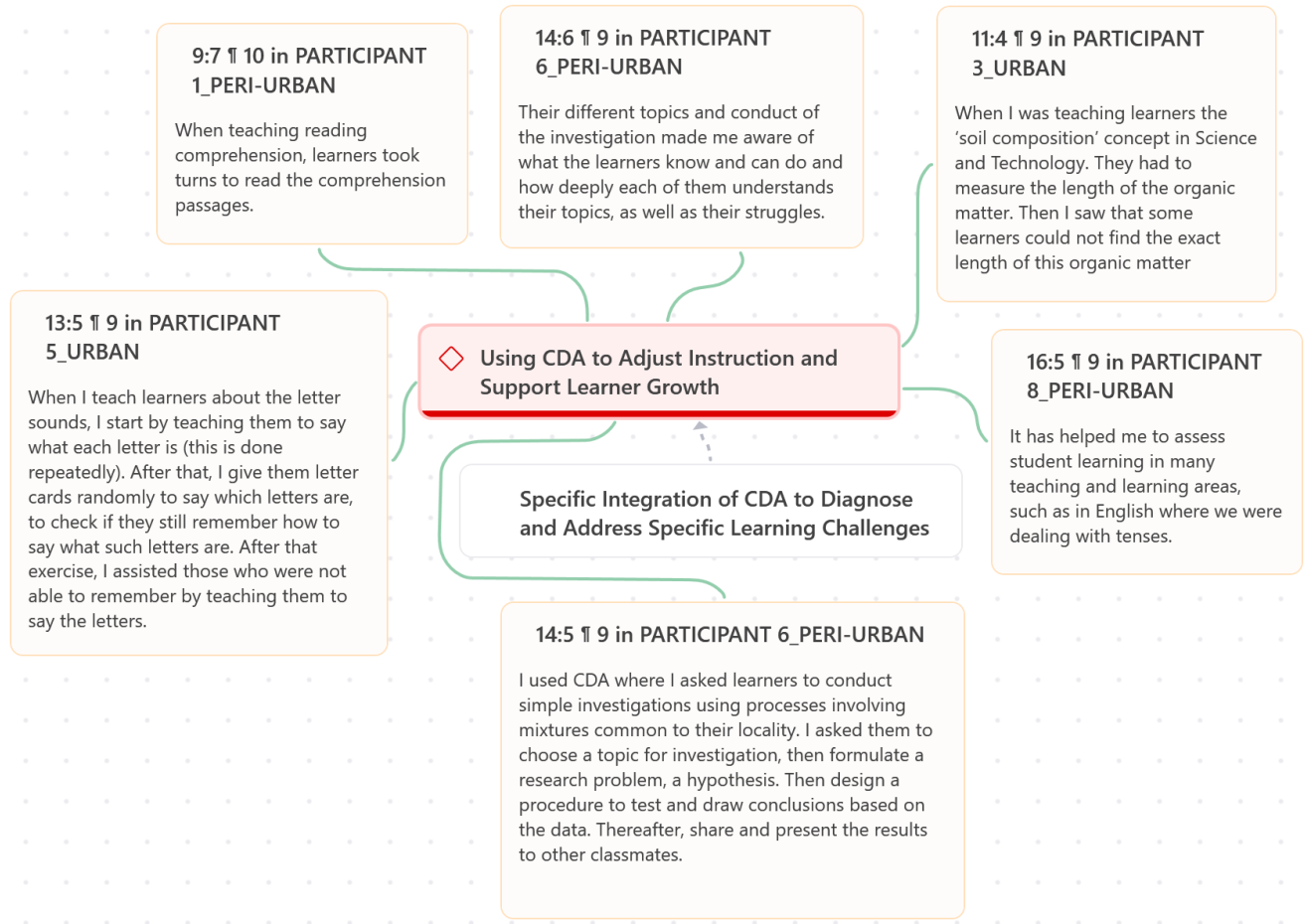


Figure 4. 8 Using CDA to adjust instruction and support learner growth

Using CDA to Identify Specific Conceptual or Skill-Based Gaps in Subject Areas

Teachers' reflective accounts demonstrate how Cognitive Diagnostic Assessment (CDA) has been systematically embedded within instructional practice to diagnose and address subject-specific learning deficiencies with precision. The findings reveal that teachers employ CDA as a diagnostic mechanism to identify discrete conceptual and procedural gaps across diverse academic domains, ranging from foundational literacy skills to complex mathematical operations and linguistic competencies. This targeted approach enables practitioners to move beyond generic remediation strategies and instead develop interventions tailored to learners' specific points of difficulty.

The data illustrate several paradigmatic examples of CDA's application in authentic classroom contexts. In literacy instruction, one teacher discerned through diagnostic assessment that while learners possessed adequate decoding skills, they struggled significantly with lexical knowledge

and reading fluency: *"Then I realized that some of my learners were able to translate written words into spoken sounds (decoding), but they struggled with vocabulary and fluency. With that feedback, I had to intervene and carry out remedials"* (P1PU). Similarly, in mathematical pedagogy, another teacher identified currency conversion as a particular stumbling block: *"While teaching the concept of 'addition of money,' most students failed to convert the lisente to Maloti. I therefore decided to conduct a CDA to find in-depth where the problem is"* (P2U).

The diagnostic precision afforded by CDA extends to highly specific skill deficiencies, as evidenced by practitioners' accounts of measuring instrument comprehension (*"Some learners could not even read the number in mm on the ruler... I used CDA to assess learners' ability"* – P3U), fractional equivalence, and grammatical tense application. This granular diagnostic capability enables teachers to implement scaffolded instructional sequences, beginning with fundamental concepts and progressively advancing to more complex applications. A particularly illustrative example emerges from composition instruction, where diagnostic assessment revealed learners' difficulties with structural elements: *"When I was teaching learners to write compositions... They did not know how to identify topic sentences"* (P7PU).

This empirical evidence collectively positions CDA as an indispensable pedagogical tool that transforms assessment data into actionable instructional intelligence. By systematically identifying the precise loci of learning breakdowns, teachers can develop targeted interventions that address individual learners' needs with unprecedented specificity. The cross-curricular application of this diagnostic approach is further exemplified in Figure 4.9, which delineates the various subject-specific implementations of CDA and their corresponding diagnostic foci.

Ultimately, these findings underscore CDA's capacity to bridge the gap between assessment and instruction, fostering a responsive teaching paradigm where pedagogical decisions are continuously informed by empirical evidence of learner understanding. The study demonstrates that when implemented with diagnostic intentionality, CDA transcends its evaluative function to become a powerful catalyst for differentiated instruction and personalised learning support.

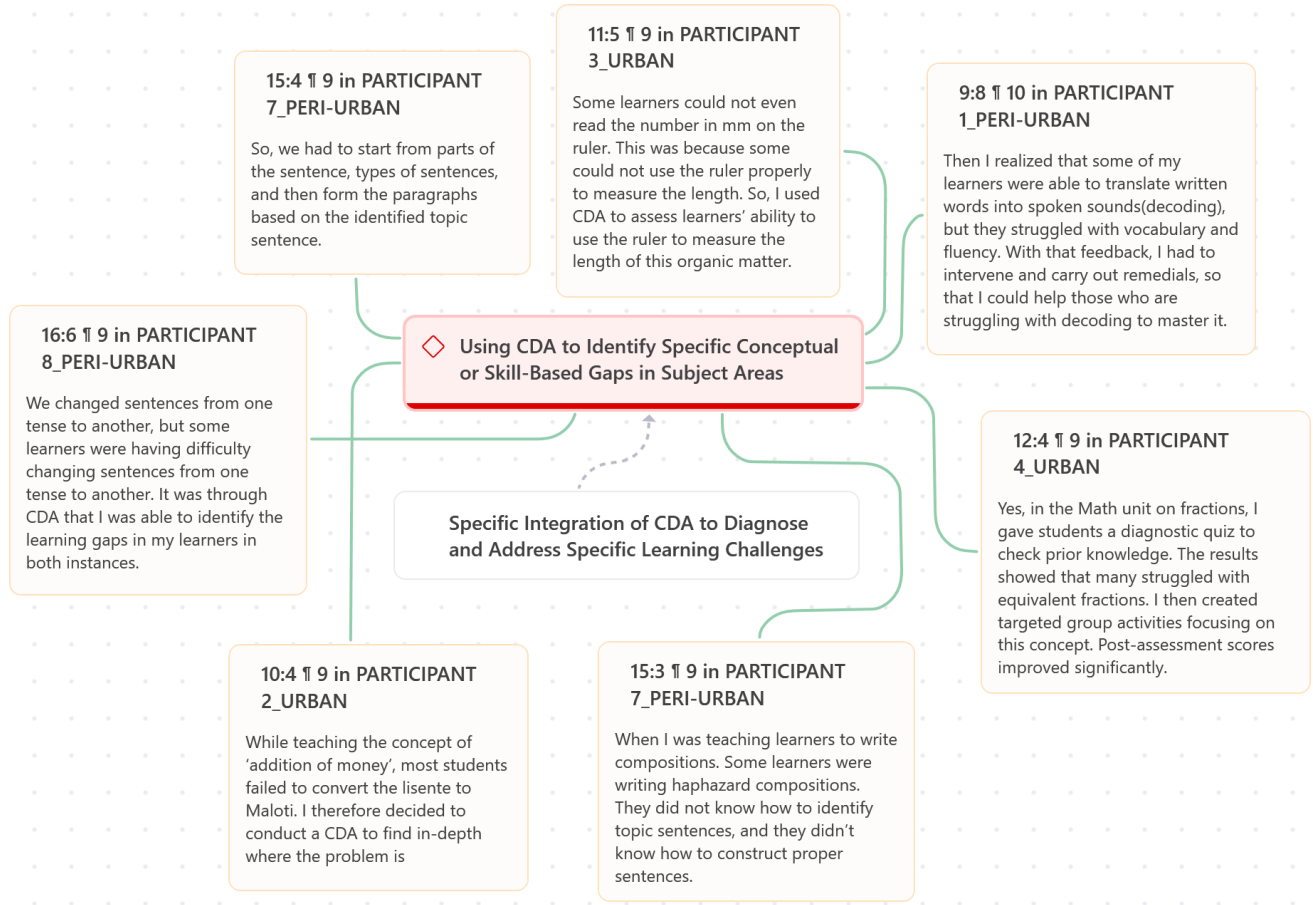


Figure 4. 9 Using CDA to identify specific conceptual or skill-based gaps in subject areas

BARRIERS TO EFFECTIVE IMPLEMENTATION OF CDA IN THE CLASSROOM

This theme elucidates the multifaceted challenges that impede teachers' ability to fully integrate Cognitive Diagnostic Assessment (CDA) into their pedagogical practice, despite recognising its potential to enhance learning outcomes. The findings reveal a tension between educators' professional commitment to diagnostic teaching and the systemic constraints that undermine its effective implementation. Three interrelated dimensions of difficulty emerge from the data, collectively demonstrating how structural deficiencies, classroom realities, and professional demands converge to limit CDA's practical application.

The first significant barrier concerns inadequate resourcing and professional preparation. Teachers consistently reported lacking the necessary materials, institutional support, and specialised training required to design and administer effective diagnostic assessments. This resource deficit

fundamentally restricts their capacity to develop and implement CDA tasks with the necessary rigour and frequency.

Compounding these material limitations is the challenge posed by learner diversity within overcrowded classrooms. The data indicate that contemporary classroom conditions characterised by large student numbers and wide variations in ability levels render the individualised approach central to CDA particularly difficult to operationalise. Teachers described profound difficulties in providing tailored feedback and managing differentiated instruction under such conditions, with classroom dynamics often prioritising behavioural management over diagnostic teaching.

Furthermore, the implementation of CDA is significantly constrained by temporal pressures and excessive workload demands. Participants highlighted how the intensive nature of diagnostic assessment requiring meticulous analysis of individual learner responses and subsequent instructional adjustments imposes unsustainable time commitments. This frequently results in professional exhaustion as teachers extend their working hours to accommodate CDA-related tasks, often at personal cost.

These barriers collectively demonstrate that while CDA holds considerable pedagogical promise, its effective implementation requires systemic reforms that address resource allocation, class size policies, and teacher working conditions. The structural nature of these challenges, as visually represented in Figure 4.10, suggests that individual teacher effort alone cannot overcome them, pointing to the need for institutional and policy-level interventions to facilitate authentic diagnostic practice.

The study ultimately reveals a paradox wherein teachers value CDA's potential to transform learning outcomes yet find themselves professionally constrained from realising this potential. This dissonance between pedagogical aspiration and classroom reality underscores the importance of aligning educational policy with classroom needs to create enabling conditions for diagnostic teaching practices. Without such alignment, CDA risks remaining an aspirational rather than operational component of classroom assessment.

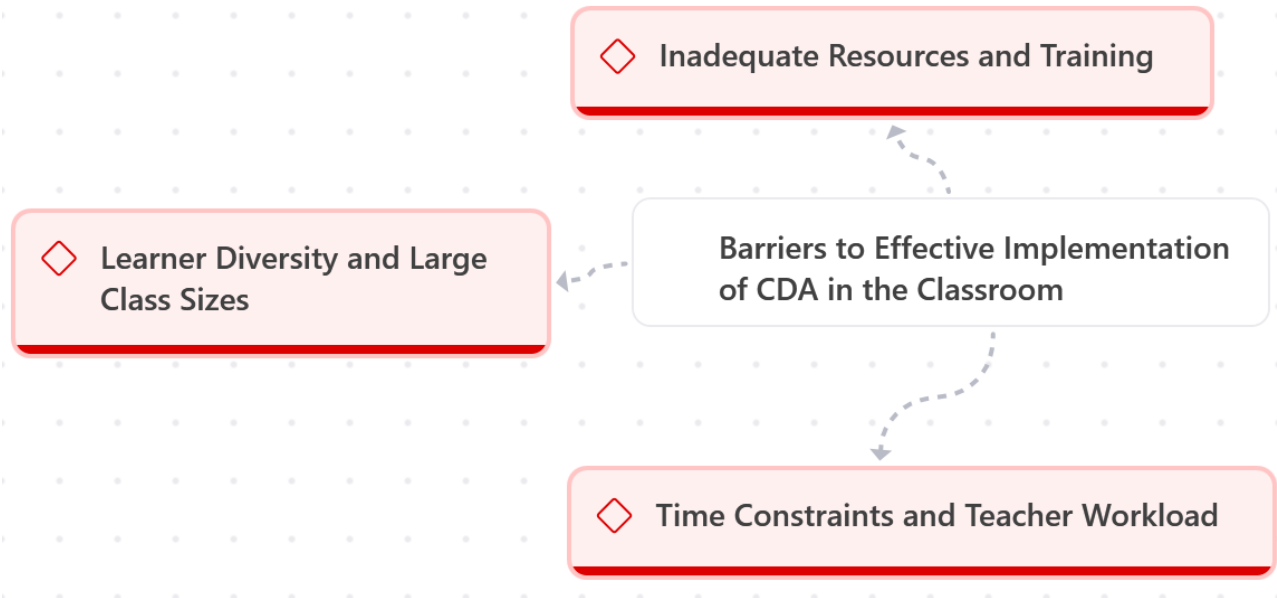


Figure 4. 10 Barriers to effective implementation of CDA in the classroom

Inadequate Resources and Training”

This theme reveals the profound systemic constraints that undermine teachers' capacity to implement Cognitive Diagnostic Assessment (CDA) effectively within classroom settings. The findings demonstrate that teachers face multifaceted challenges spanning material, financial, and pedagogical domains, which collectively inhibit the integration of diagnostic assessment practices. Teachers' accounts consistently highlight a critical resource deficit that operates at multiple levels, fundamentally restricting their ability to employ CDA as intended.

The data illustrate significant material shortcomings, with participants explicitly citing inadequate physical resources as a primary impediment. As one teacher explained, *"Lack of resources to help me implement CDA effectively. I was also struggling when trying to design the cognitive tasks"* (P1PU), revealing both practical and technical obstacles in operationalising diagnostic assessment. The financial implications of resource acquisition further exacerbate these challenges, as noted: *"Again, if additional materials are needed, funding is also needed, thus making learning expensive"* (P5U). This sentiment is reinforced by another participant's observation: *"Lack of resources hindered my ability to implement CDA successfully"* (P6PU), underscoring how material deficiencies directly compromise assessment quality.

Beyond tangible resources, structural and professional development gaps emerge as equally constraining factors. Teachers identified inadequate training and unsuitable classroom conditions

as critical barriers, exemplified by the statement: *"Overcrowded classrooms and limited training that I obtained on the use of CDA in classrooms"* (P6PU). Another participant's truncated remark *"Lack of resources, like specialised..."* (P8PU) suggests additional unmet needs for subject-specific diagnostic tools, hinting at a broader systemic failure to provide appropriate assessment infrastructure.

These findings collectively underscore three interrelated implementation barriers: insufficient material resources, financial constraints, and inadequate professional preparation. When combined with the challenges of learner diversity and large class sizes as visually synthesised in Figure 4.11 they create a compounded effect that renders CDA implementation particularly problematic. The study ultimately demonstrates that without addressing these foundational capacity issues through targeted teacher training, improved resource allocation, and classroom condition optimisation, the potential benefits of diagnostic assessment risk remaining unrealised. The barriers identified are not merely operational but structural, requiring policy-level interventions to create enabling conditions for effective CDA adoption.

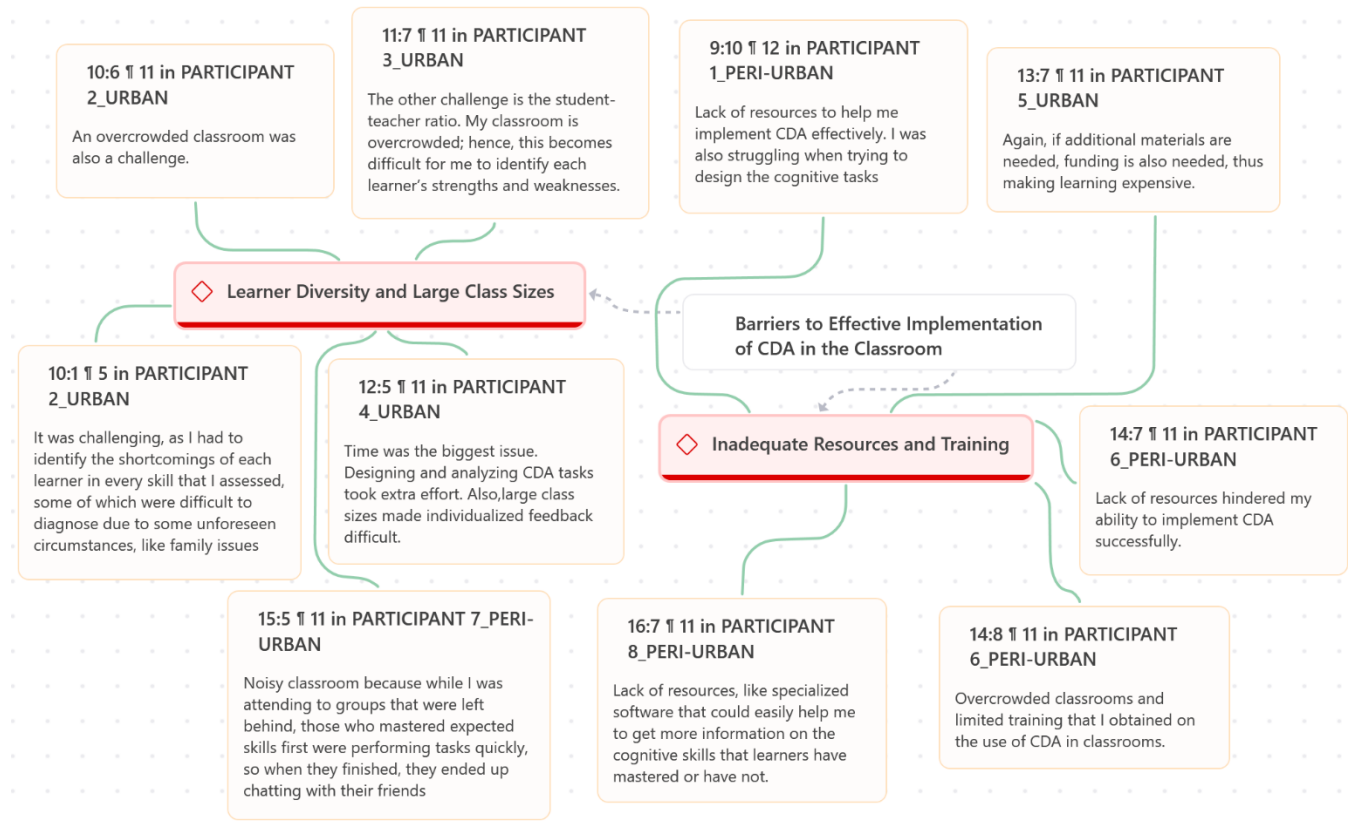


Figure 4.11 Learner diversity and large class size and inadequate resources, and training

Learner Diversity and Large Class Sizes

This theme illustrates the substantive implementation barriers that emerge when applying Cognitive Diagnostic Assessment (CDA) within educational contexts characterised by high student-teacher ratios and heterogeneous learner profiles. The findings reveal a fundamental tension between the diagnostic precision required by CDA methodologies and the practical realities of overburdened classroom environments. Teachers' accounts consistently highlight three interrelated constraints: the diagnostic challenges posed by learner diversity, the logistical limitations of overcrowded classrooms, and the temporal pressures inherent in maintaining both assessment rigor and classroom management.

The data demonstrate that the process of identifying individual learning deficiencies becomes markedly more complex in diverse classroom settings. As one participant articulated, *"It was challenging, as I had to identify the shortcomings of each learner in every skill that I assessed, some of which were difficult to diagnose due to some unforeseen circumstances, like family issues"* (P2U). This observation accentuates how extraneous psychosocial factors further complicate the diagnostic process, requiring teachers to disentangle cognitive gaps from contextual influences a demanding task in resource-constrained environments.

The impediment of excessive class sizes emerges as a persistent theme, with multiple practitioners emphasising its detrimental impact on diagnostic efficacy. The straightforward assertion *"An overcrowded classroom was also a challenge"* (P2U) is substantiated by more detailed accounts such as *"My classroom is overcrowded; hence, this becomes difficult for me to identify each learner's strengths and weaknesses"* (P3U). These conditions fundamentally undermine CDA's core purpose by rendering individualised assessment impractical, despite teachers' professional commitment to diagnostic principles.

Temporal constraints compound these difficulties, creating a trilemma between assessment depth, classroom management, and instructional pacing. One teacher's explanation *"Time was the biggest issue. Designing and analyzing CDA tasks took extra effort. Also, large class sizes made individualized feedback difficult"* (P4U) reveals how logistical pressures erode the capacity for meaningful implementation. Furthermore, the inherent challenges of differentiated instruction in crowded settings are poignantly captured in the observation: *"Noisy classroom because while I was attending to groups that were left behind, those who mastered expected skills first were performing tasks quickly, so when they finished, they ended up chatting with their friends"* (P7PU).

This scenario illustrates the disruptive classroom dynamics that can emerge when attempting to reconcile varied learning paces within a single instructional space.

In sum, these findings demonstrate that the successful integration of CDA requires more than teacher competency it necessitates structural conditions that enable focused diagnostic attention. The study reveals a fundamental mismatch between the individualised nature of cognitive diagnostics and the massified reality of contemporary classrooms. Without systemic interventions to address class size reduction, allocation of diagnostic planning time, and support for classroom management strategies, the transformative potential of CDA may remain constrained by operational realities rather than pedagogical limitations. The implications suggest that policy level adjustments to teaching loads and classroom compositions may be prerequisite to meaningful CDA adoption, rather than supplementary considerations.

Time Constraints and Teacher Workload

This theme affirms one of the most substantial impediments to the effective adoption of Cognitive Diagnostic Assessment (CDA) in classroom practice: the excessive temporal and cognitive demands it places on teaching professionals. The findings reveal a fundamental tension between the rigorous requirements of diagnostic assessment and the practical realities of instructional delivery, with teachers consistently reporting unsustainable workload pressures that compromise both implementation fidelity and professional wellbeing.

The data demonstrate that CDA's intensive nature frequently disrupts standard pedagogical workflows. As one participant succinctly noted, "*It delayed my lessons*" (P1PU), while further elaborating that "*Since it consumes a lot of time, this is because I must attend to every learner in the classroom*" (P1PU). These observations underscore how the individualised attention central to CDA inevitably conflicts with the temporal constraints of fixed teaching schedules. The challenges are compounded in skill-specific assessments, where diagnostic clarity proves particularly time-intensive to achieve: "*Because it was oral, most failed to read money when written on the chalkboard, but they could only count it*" (P2U).

The temporal burden extends across multiple dimensions of CDA implementation. Teachers report significant time investments in both assessment administration ("*It was time-consuming*" – P2U) and subsequent analysis, particularly when addressing fundamental skill deficiencies. One participant's account of measurement activities - "*The lesson took a lot of time*" (P3U) typifies how

diagnostic processes inevitably expand lesson duration when confronting learning obstacles. Furthermore, the preparatory demands of designing structured diagnostic tasks create additional pressures, as captured in the reflection: *"Teaching and diagnosing the learning problems of every learner consumes a lot of time... and some learners need more time to recall"* (P5U).

The cumulative effect of these demands manifests in concerning patterns of professional exhaustion. Multiple participants described the personal toll of maintaining diagnostic practices within existing institutional constraints, with characteristic remarks including *"It is exhausting... even during break time or to have extra teaching hours"* (P5U) and *"It was also time-consuming and tiring"* (P7PU; P8PU). These accounts reveal an unsustainable professional dynamic where diagnostic rigor is achieved at the expense of teacher wellbeing.

In total, these findings demonstrate that the effective institutionalization of CDA requires systemic solutions that address its inherent temporal demands. The current implementation paradigm - which essentially transfers the logistical burden of diagnostic assessment onto individual teachers' discretionary time represents a fundamental barrier to sustainable adoption. As illustrated in Figure 4.12, the interrelated challenges of time constraints and workload intensity emerge as critical factors requiring policy-level intervention. Potential solutions might include dedicated diagnostic planning periods, reduced teaching loads for assessment-intensive periods, or the development of streamlined diagnostic tools that maintain rigor while improving efficiency. Without such structural supports, the transformative potential of CDA risks being undermined by implementation fatigue and compromised teacher capacity.

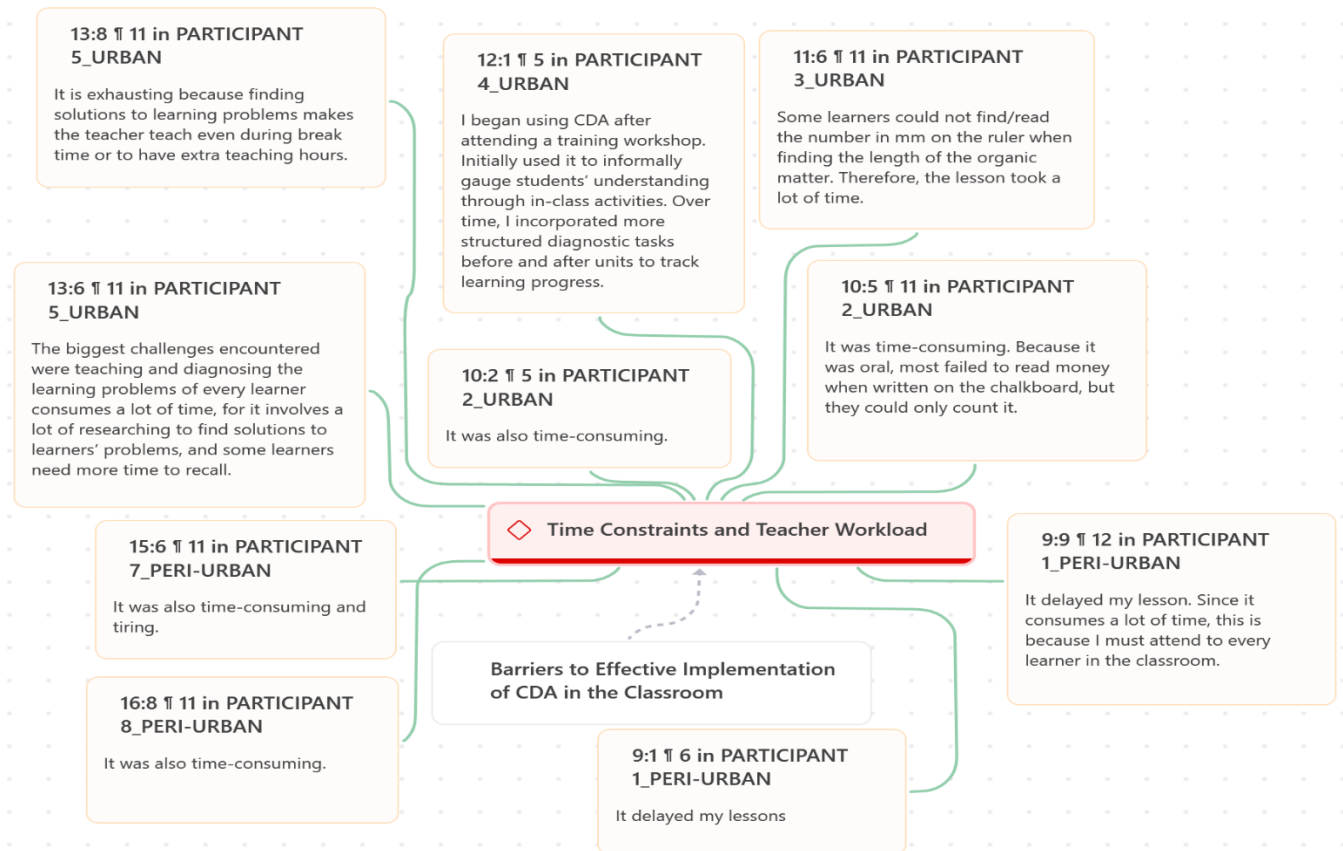


Figure 4. 12 Time constraints and teacher workload

POSITIVE TRANSFORMATIONS IN TEACHING AND LEARNING THROUGH CDA

The implementation of Cognitive Diagnostic Assessment (CDA) has precipitated significant transformations in both instructional approaches and learning outcomes, marking a departure from conventional assessment paradigms. This thematic analysis reveals how CDA's diagnostic precision has fundamentally reconfigured teaching practices while simultaneously enhancing learner engagement and academic achievement.

At the pedagogical level, CDA has empowered educators to transition from standardised instructional methods to more nuanced, responsive teaching strategies. By providing comprehensive insights into individual learners' cognitive profiles, the assessment framework enables teachers to develop precisely targeted interventions that address specific learning gaps. This diagnostic capability fosters a more reflective approach to lesson planning, where instructional decisions are grounded in empirical evidence rather than generalised assumptions.

Teachers report increased confidence in tailoring their pedagogical approaches to accommodate heterogeneous learning needs, resulting in more differentiated and effective classroom practices.

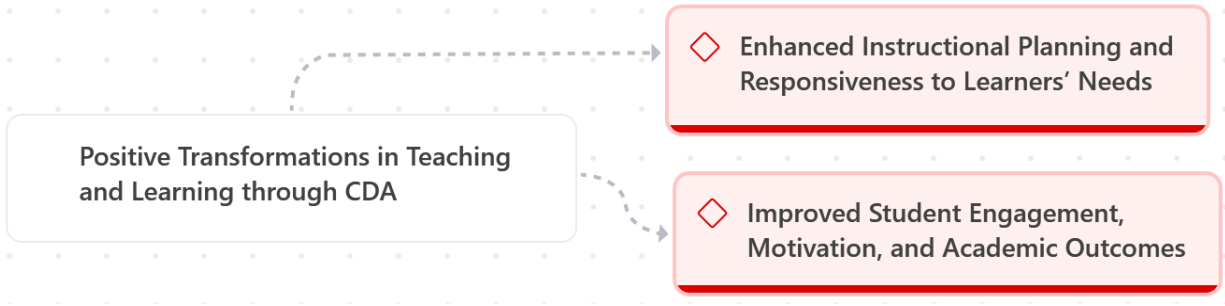
The ripple effects of these instructional shifts are evident in measurable improvements across multiple dimensions of learner performance. Students demonstrate enhanced academic outcomes attributable to the personalised support facilitated by CDA's diagnostic precision. Beyond quantitative achievement metrics, qualitative reports indicate heightened learner motivation and self-efficacy, as the assessment process makes visible both current competencies and achievable progression pathways. The framework's capacity to identify and validate individual learning trajectories has been particularly transformative in fostering inclusive classroom environments where diverse cognitive needs are systematically recognised and addressed.

These pedagogical and learning transformations are visually synthesised in Figure 4.13, which maps the multifaceted positive impacts observed across teaching methodologies and learner experiences. The schematic representation underscores CDA's role as both an assessment tool and a catalyst for educational innovation, bridging the critical gap between diagnostic insight and instructional action.

The cumulative evidence positions CDA as more than an evaluative mechanism - it emerges as an integral driver of teaching excellence and learner success. When properly implemented, the framework transcends its basic assessment function to become a powerful lever for pedagogical refinement and equitable educational outcomes. These findings carry important implications for both classroom practice and educational policy, suggesting that the strategic integration of diagnostic assessment methodologies can significantly enhance the quality and effectiveness of teaching and learning processes.

Figure 4.13: Positive transformations in teaching and learning through CDA

where no student is left behind.



Enhanced Instructional Planning and Responsiveness to Learners' Needs

This analysis demonstrates how Cognitive Diagnostic Assessment (CDA) has fundamentally reshaped instructional practice through its capacity to generate precise diagnostic insights into learners' cognitive profiles. The results demonstrate how Cognitive Diagnostic Assessment (CDA) has fundamentally reshaped instructional practice through its capacity to generate precise diagnostic insights into learners' cognitive profiles. The findings reveal that CDA serves as a transformative mechanism in education, facilitating a shift from undifferentiated teaching approaches to precisely targeted pedagogical strategies grounded in empirical evidence of student understanding.

Participant accounts consistently highlight CDA's role in revolutionising lesson planning processes, with teachers reporting more deliberate and learner-centered approaches to curriculum design. The framework's diagnostic precision enables teachers to move beyond assumptions about class-wide understanding to instead base instructional decisions on individual learners' demonstrated competencies and difficulties. This evidentiary approach to pedagogy represents a significant advancement in classroom practice, as captured in one teacher's reflection that CDA provides *"a clear path of where and how to assist the learners"* through systematic diagnosis of problems and strengths (P5U).

A particularly noteworthy finding concerns CDA's capacity to surface previously unrecognized learning obstacles. Several educators reported that the assessment framework revealed difficulties that had escaped detection through conventional evaluation methods, enabling more timely and appropriate interventions. This diagnostic function addresses a critical gap in standard assessment practices, which often fail to identify the root causes of learning challenges. As one participant noted, CDA's revelations led to *"a better understanding of the needs of such a student"* and enabled *the application of "suitable approaches"* (P3U).

The framework's impact extends across multiple dimensions of teaching practice. Teachers report enhanced capacity to design instruction that precisely targets identified knowledge gaps while simultaneously creating appropriate enrichment opportunities for advanced students. This dual capacity to both remediate and extend learning represents a significant advancement in classroom differentiation. Furthermore, the assessment process fosters more inclusive educational environments by systematically identifying and addressing diverse learning needs within heterogeneous classrooms.

These pedagogical improvements have yielded measurable benefits in student engagement and academic achievement. Teachers observe increased learner participation and deeper conceptual understanding when instruction is informed by CDA's diagnostic insights. The framework's capacity to make learning progression visible to both educators and students appears to enhance motivation and self-efficacy among learners.

The full scope of these instructional transformations is captured in Figure 4.14, which visually represents the enhanced planning processes and responsive teaching practices enabled by CDA implementation. This schematic synthesis underscores the framework's role as both an assessment tool and a catalyst for pedagogical innovation, effectively bridging the gap between diagnostic insight and instructional action.

These findings position CDA as more than an evaluative mechanism - it emerges as a powerful driver of teaching excellence when properly integrated into classroom practice. The framework's demonstrated capacity to inform and refine instructional approaches suggests significant potential for improving educational outcomes through systematic implementation. This evidence carries important implications for both classroom practice and educational policy, highlighting the value of diagnostic assessment methodologies in contemporary pedagogy.

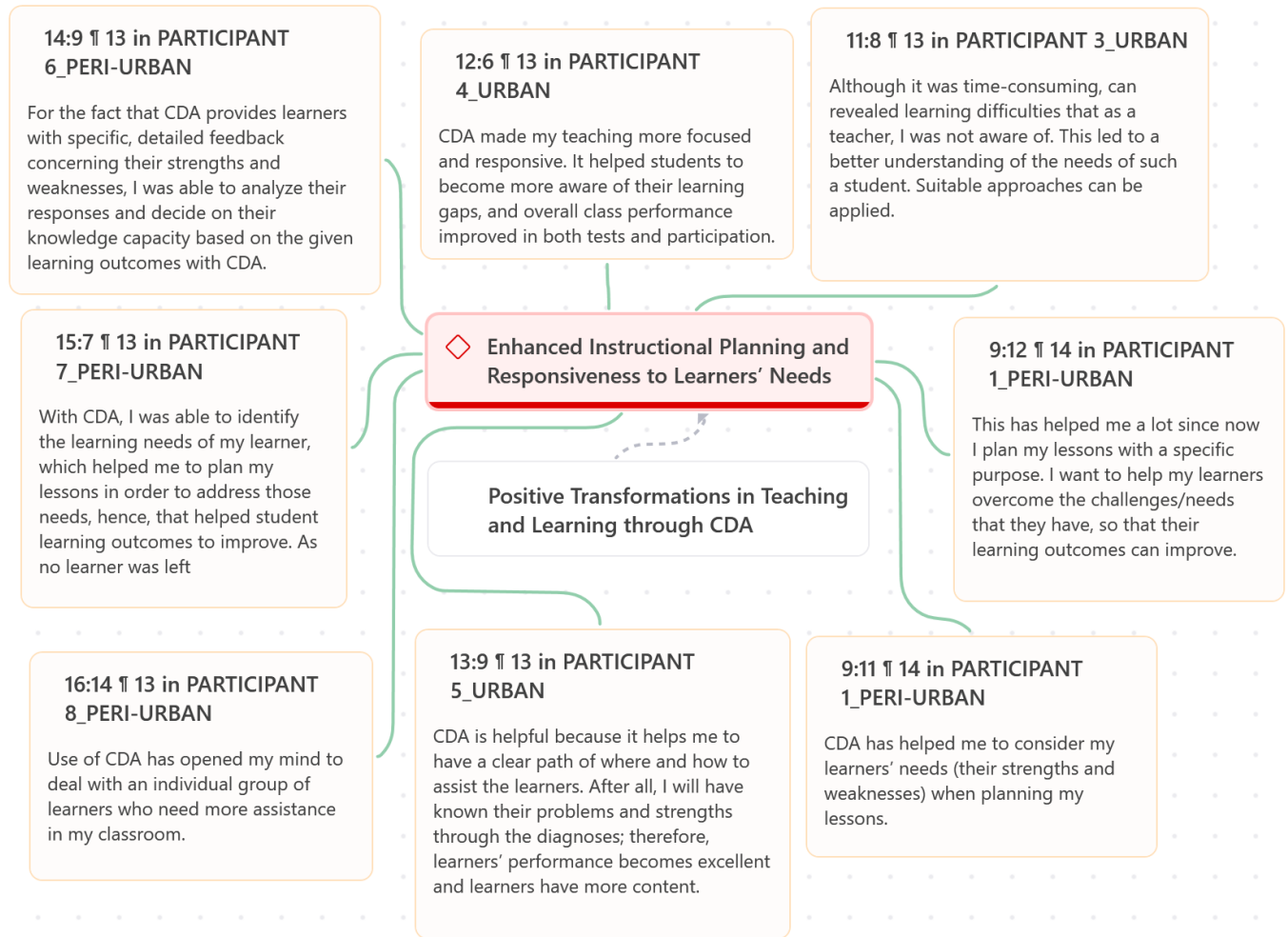


Figure 4.14 Enhanced instructional planning and responsiveness to learners' needs

Improved Student Engagement, Motivation, and Academic Outcomes

This sub-theme elucidates the significant pedagogical benefits arising from the implementation of Cognitive Diagnostic Assessment (CDA), particularly in relation to enhanced learner participation and measurable academic improvement. The findings demonstrate that CDA fosters an inclusive and dynamic learning environment wherein students across the ability spectrum exhibit increased engagement in skill acquisition and goal-directed learning processes.

Teachers' qualitative reports reveal consistent patterns of positive behavioural and cognitive changes among learners following CDA integration. One participant articulated this transformative effect, observing that *"Every learner is fully engaged in any skill developed. Every*

learner is going to acquire the skills that are needed. As a result, student learning outcomes will improve" (P2U). This testimony underscores CDA's capacity to promote universal participation while simultaneously raising academic standards.

A particularly noteworthy finding concerns the framework's role in stimulating motivational dynamics within the classroom. As one teacher noted, *"It has also created good competition among my learners. Those who are able and unable ones. The learners who are struggling, now work hard in order to improve their results"* (P8PU). This observation highlights how CDA's transparent progress tracking fosters a productive learning culture where both high-achieving and struggling students are incentivised to advance their understanding.

The assessment methodology further demonstrates value in making learning progression visible and tangible. Teachers reported enhanced capacity to monitor and validate student development, as exemplified by the account: *"I was able to see an impact when learners demonstrated their understanding or tried extremely hard to achieve an objective"* (P6PU). This diagnostic clarity appears to create a positive feedback loop wherein clear objectives and continuous assessment reinforce learner self-efficacy and persistence.

These qualitative findings are systematically represented in Figure 4.15, which synthesises teachers' perspectives on CDA's multifaceted impact on student engagement, motivation, and academic achievement. The visual schema confirms that the framework's benefits extend beyond mere assessment utility to actively shape productive learning behaviours and classroom dynamics. Collectively, the evidence positions CDA as a powerful pedagogical tool that transcends conventional assessment functions. By making learning processes explicit and progress measurable, the framework appears to: catalyse inclusive participation; stimulate healthy academic competition; and foster mastery-oriented learning behaviours. These outcomes suggest that CDA's implementation warrants serious consideration as a strategy for enhancing both the quality and equity of educational outcomes in diverse classroom settings. The findings carry significant implications for contemporary pedagogical practice and merit further investigation through longitudinal research designs.



Figure 4.15 Improved student engagement, motivation, and academic outcomes

EFFECTIVE STRATEGIES FOR INTEGRATING CDA INTO INSTRUCTIONAL PLANNING

This theme examines how teachers systematically embed Cognitive Diagnostic Assessment (CDA) within their instructional frameworks to cultivate more precise, responsive, and impactful learning experiences. The findings reveal a paradigm shift in assessment methodology, wherein diagnostic evaluation transitions from a peripheral or summative activity to an integral, formative component of daily teaching practice. This transformation manifests through two interrelated dimensions that collectively redefine the relationship between assessment and instruction.

The first dimension, *Continuous, Embedded Assessment Aligned with Learning Objectives*, captures how teachers design CDA tasks that are intrinsically connected to curricular goals and instructional sequences. Rather than treating assessment as an isolated event, practitioners develop diagnostic activities that provide real-time insights into learners' conceptual understanding and skill acquisition. This approach enables immediate pedagogical adjustments, ensuring that instruction remains dynamically responsive to emerging learning needs. The embedded nature of these assessments allows for ongoing progress monitoring while maintaining instructional momentum, effectively blurring the traditional boundaries between teaching and evaluation.

The second dimension, *Learner-Centred Grouping and Active Engagement Approaches*, demonstrates how diagnostic insights inform the organisation of classroom activities and learner interactions. Teachers employ flexible grouping strategies that are continually reconfigured based on CDA-derived data, creating fluid learning environments where peer collaboration and targeted instruction coexist. These adaptive groupings are complemented by interactive methodologies that promote active knowledge construction, ensuring that all learners remain cognitively engaged with appropriately challenging material. This dual focus on diagnostic-informed grouping and participatory pedagogies represents a significant advancement in differentiated instruction.

These strategic approaches are visually synthesised in Figure 4.16, which delineates the effective methodologies for incorporating CDA within instructional planning. The schematic representation underscores how these sub-themes operate synergistically to create a cohesive system of diagnostic teaching.

Inclusively, the findings illustrate a fundamental reorientation of classroom assessment practices from static, periodic evaluation to dynamic, instructionally integrated diagnosis. This shift reflects broader pedagogical evolution towards more nuanced, evidence-based teaching that prioritises individual learning trajectories over standardised delivery. The implications suggest that when properly implemented, CDA transcends its evaluative function to become a powerful catalyst for instructional innovation and learning optimisation. The study contributes to contemporary discourse on formative assessment by demonstrating how diagnostic methodologies can be operationalised within authentic classroom contexts to enhance both teaching precision and learning outcomes.

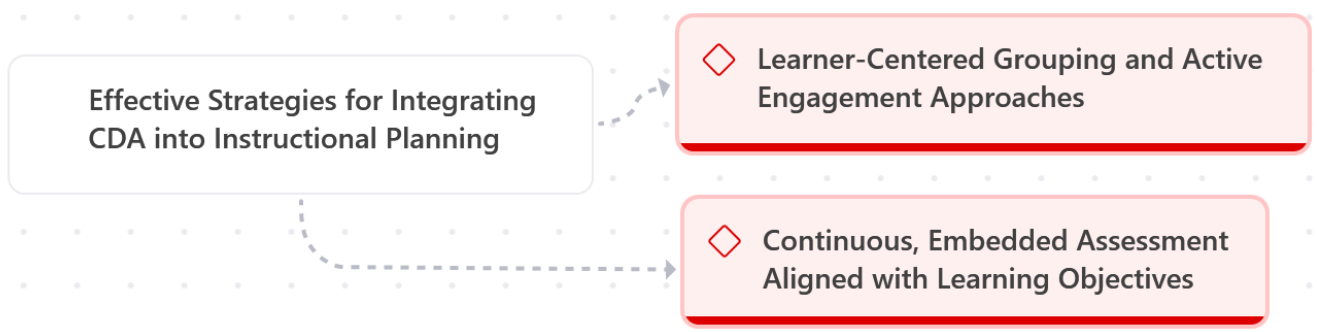


Figure 4.16 *Effective strategies for integrating CDA into instructional planning*

Continuous, Embedded Assessment Aligned with Learning Objectives

This sub-theme demonstrates how teachers systematically incorporate Cognitive Diagnostic Assessment (CDA) into their pedagogical approach by establishing explicit connections between assessment tasks and defined learning objectives, while utilising real-time diagnostic feedback to guide instructional decision-making. The findings reveal that practitioners employ CDA not as a discrete evaluative exercise, but as an embedded component of daily teaching practice that actively shapes lesson delivery.

Participant accounts highlight multiple approaches to this integration. One teacher described an immediate feedback mechanism: *"I give my learners a task, then I mark it during the class, still recording down who mastered the skills assessed, and who did not"* (P1PU). This practice facilitates responsive pedagogical adjustments, as evidenced by another educator's reflection: *"I look at the recorded results, analyse them. Then decide whether to give an extra class"* (P1PU). The deliberate alignment of assessment with curricular goals emerges as a critical factor, with participants emphasising purposeful task design: *"I specify the objectives that learners are expected to master, then I design the assessment task that aligns well with my defined objectives"* (P6PU).

Teachers further reported seamlessly incorporating diagnostic activities within standard lesson sequences rather than treating them as supplementary exercises. As one participant noted: *"I embedded CDA tasks into the lesson sequence rather than treating them as extras"* (P4U). This integration extends to observational assessment strategies, where educators monitor learner understanding during instruction: *"I observed my learners during lessons, which helped me to see where they struggle, so that I can intervene"* (P7PU).

These practices collectively illustrate how CDA informs a dynamic, evidence-based instructional model where teaching responds continuously to demonstrated learner needs. The various methodologies employed by teachers to embed CDA within their practice while maintaining alignment with learning objectives are systematically presented in Figure 4.17.

The findings underscore CDA's transformative potential when implemented as an organic component of pedagogical practice rather than as an isolated assessment event. This approach represents a significant advancement in formative assessment methodology, promoting teaching that is both precisely targeted and flexibly adaptive to individual learner requirements. The study contributes to contemporary educational research by demonstrating practical mechanisms through

which diagnostic assessment can be effectively operationalised within authentic classroom contexts.

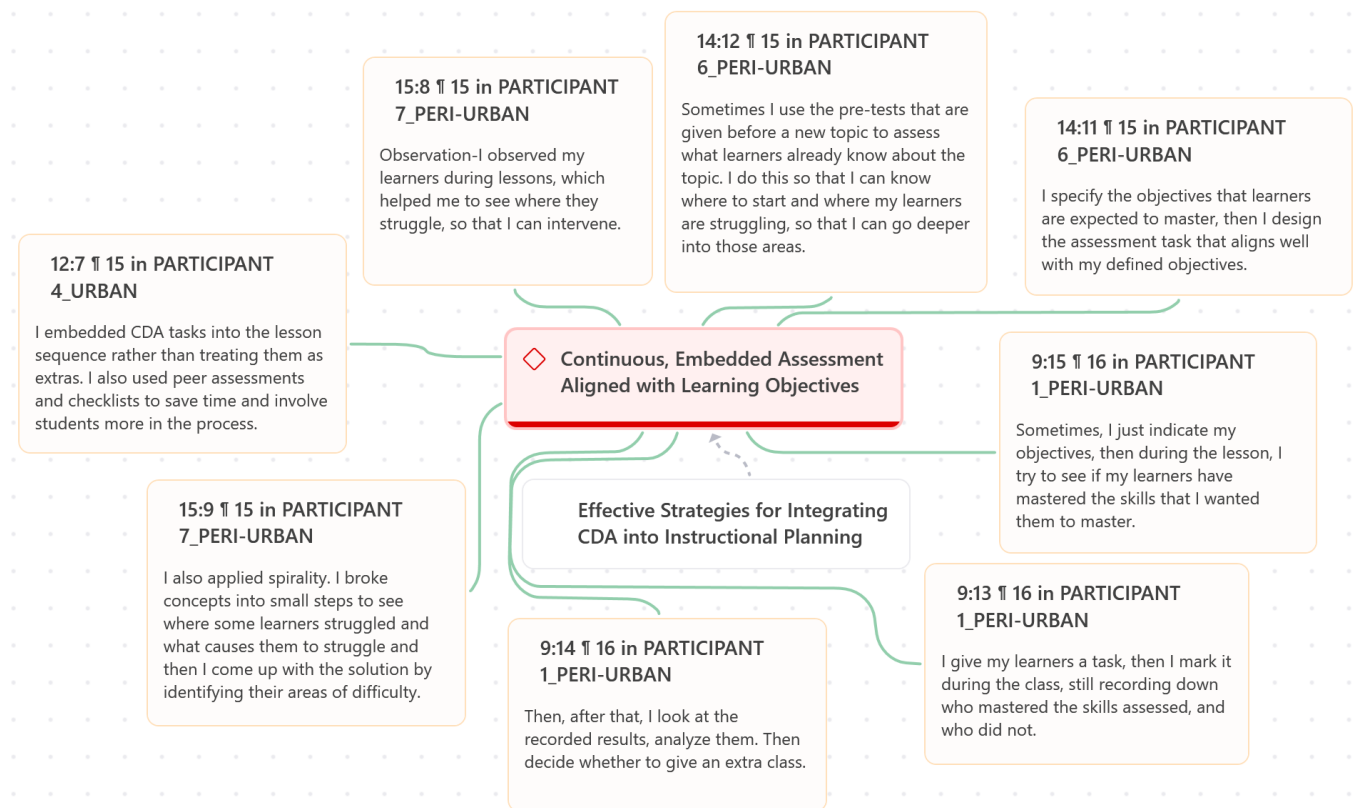


Figure 4.17 Continuous, embedded assessment aligned with learning objectives

Learner-Centered Grouping and Active Engagement Approaches

This sub-theme elucidates how teachers employ purposeful grouping strategies and interactive pedagogical techniques to optimise the implementation of Cognitive Diagnostic Assessment (CDA) within classroom settings. The findings demonstrate that structured learner groupings, when informed by diagnostic data, facilitate both targeted instructional support and enhanced cognitive engagement, thereby maximising the efficacy of CDA processes.

Participant accounts reveal several salient approaches to this strategic implementation. One teacher described a rotational group model designed to balance individualised attention with collaborative learning: *"I grouped learners in groups of 5 and had to attend to each in a group while others carried on their given tasks"* (P2U). This methodology exemplifies how diagnostic assessment can

be operationalised within small-group configurations without compromising overall classroom productivity.

The pedagogical value of cooperative learning structures emerges strongly from the data, with one educator succinctly noting "*Cooperative learning helped a lot*" (P3U). This finding is further substantiated by reports of diverse engagement methodologies, including "*Peer learning, group learning, playing video games, Jolly Phonics, and using other materials helped a lot*" (P5U), indicating that multimodal instructional approaches complement and enhance diagnostic assessment practices.

A particularly significant finding concerns the cognitive alignment of grouping strategies with diagnostic outcomes. As one participant emphasised, "*Grouping learners according to their cognitive weaknesses helped a lot*" (P8PU), suggesting that needs-based clustering enables more precise instructional interventions. This approach represents a sophisticated application of diagnostic data to inform classroom organisation, moving beyond conventional ability grouping towards more nuanced, criterion-referenced configurations.

These collective strategies foster a dynamic learning environment where CDA becomes both pedagogically manageable and instructionally impactful. The resultant classroom ecology supports continuous diagnostic evaluation while maintaining high levels of learner participation and engagement.

For clarity, Figure 4.18 provides a schematic representation of the various grouping methodologies employed by teachers to facilitate active learner involvement during CDA implementation. This visual synthesis demonstrates how diagnostic-informed grouping strategies create optimal conditions for both assessment and instruction within contemporary classroom contexts.

The study contributes to existing literature by demonstrating how strategic classroom organisation can enhance the practical application of diagnostic assessment methodologies. These findings have significant implications for teacher professional development, suggesting that training in diagnostic-informed grouping strategies may represent a critical component of effective CDA implementation. The evidence underscores the importance of viewing classroom grouping not merely as a management strategy, but as an integral element of sophisticated assessment practice.

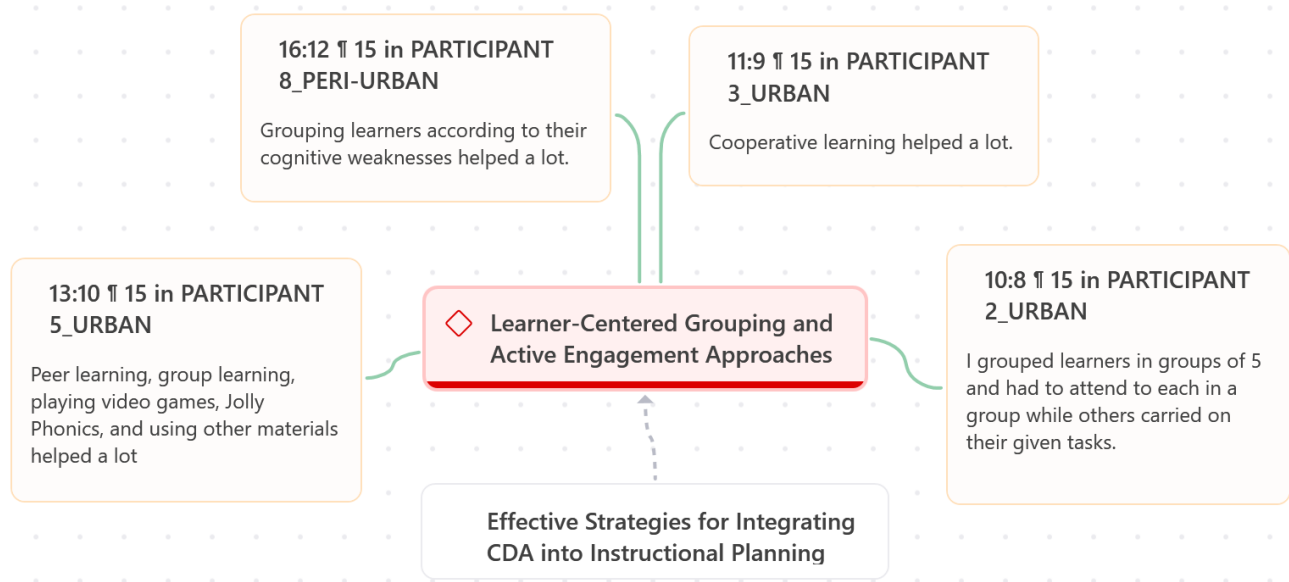


Figure 4.18 Learner-centred grouping and active engagement approaches

Question 2: How do practicing teachers perceive the effectiveness of CDA in improving their classroom assessment practices?

PERCEPTION OF CDA AS A SUPERIOR ALTERNATIVE TO TRADITIONAL ASSESSMENT METHODS

This theme articulates participants' conviction that Cognitive Diagnostic Assessment (CDA) constitutes a substantively more effective and pedagogically sophisticated approach than conventional assessment paradigms. The data reveal a consensus among practitioners that CDA transcends the limitations of traditional evaluative methods which they characterised as predominantly summative and preoccupied with comparative metrics by yielding granular insights into individual learners' cognitive architectures. This diagnostic precision is perceived to facilitate precisely calibrated pedagogical interventions that address specific learning needs while capitalising on demonstrated competencies.

Two interrelated conceptual dimensions emerge from participants' accounts, collectively positioning CDA as both a diagnostic mechanism and an instructional catalyst. The first dimension, *Deeper Diagnostic Insight and Individualised Learning Support*, encapsulates educators' perceptions of CDA's capacity to illuminate the nuanced topography of each learner's

understanding. Unlike standardised assessments that merely quantify performance, CDA is reported to reveal the qualitative dimensions of knowledge acquisition - identifying not just *whether* students have mastered concepts, but *how* they have constructed understanding and *where* precisely their comprehension falters. This epistemological transparency enables teachers to move beyond generic remediation strategies towards bespoke instructional scaffolding tailored to individual cognitive profiles.

The second dimension, *Timely, Formative Feedback for Improved Instruction and Learning Outcomes*, reflects participants' appreciation of CDA's dynamic, iterative nature. Practitioners emphasised the framework's capacity to generate actionable intelligence during the learning process itself, rather than retrospectively. This formative orientation allows for real-time pedagogical adjustments that proactively address emerging difficulties before they crystallise into entrenched misconceptions. The consequent feedback loop between assessment, diagnosis and instruction creates a virtuous cycle wherein teaching responsiveness begets learning efficacy.

These perceptual frameworks are systematically represented in Figure 4.19, which delineates educators' comparative evaluation of CDA against traditional assessment modalities. The schematic illustrates how these sub-themes coalesce to position CDA as a pedagogically superior alternative one that reconfigures assessment from a terminal judgement into an integral, improvement oriented component of the learning process itself.

The findings carry significant implications for contemporary assessment discourse, suggesting that CDA's perceived value resides not merely in its diagnostic acumen, but in its capacity to reconceptualise the fundamental relationship between evaluation and instruction. Participants' accounts collectively advocate for an assessment paradigm that prioritises understanding over ranking, growth over benchmarking, and individual progress over normative comparison. This evidence base strengthens the theoretical argument for diagnostic assessment models that are both psychologically grounded and pedagogically empowering.



Figure 4. 19 Perception of CDA as a superior alternative to traditional assessment methods

Deeper Diagnostic Insight and Individualized Learning Support

This thematic analysis demonstrates a consensus among teachers regarding the superior diagnostic capabilities of Cognitive Diagnostic Assessment (CDA) when compared to conventional assessment methodologies. The findings reveal that practitioners perceive CDA as offering substantially greater analytical depth in evaluating student competencies, providing multidimensional insights that extend beyond the limitations of traditional evaluative frameworks. Participants consistently reported that CDA facilitates a comprehensive understanding of individual learners' cognitive profiles by simultaneously identifying areas of proficiency and deficiency. This dual diagnostic capacity is exemplified in participant accounts such as *"It also helps me to diagnose student learning, identify their strengths and weaknesses"* (P1PU) and *"CDA helped me pay attention to the strengths and weaknesses of individual learners per skill taught in class"* (P2U). These observations underscore CDA's ability to yield granular, skill-specific data that traditional assessment approaches typically obscure.

A critical distinction emerging from the data concerns the fundamental orientation of assessment paradigms. Participants contrasted CDA's diagnostic precision with traditional methods that *"only focus on scoring the learners without identifying the skills where learners are lacking or mastering"* (P1PU). This comparative analysis highlights how conventional assessments' preoccupation with summative quantification fails to provide the actionable intelligence necessary for targeted pedagogical intervention.

The formative utility of CDA is further emphasised through participants' appreciation of its capacity to generate *"clear feedback compared to traditional assessment"* and *"a clear picture of*

students' progress" (P3U). Such feedback mechanisms enable teachers to develop precisely calibrated instructional responses tailored to individual learning trajectories. This transformative potential is encapsulated in the assertion that CDA is *"more effective than traditional assessment because it allows me to understand what learners already know as individuals, what they do not know, and how they can learn best"* (P6PU).

The data collectively position CDA as both an assessment innovation and a pedagogical framework that reconfigures the relationship between evaluation and instruction. As one participant articulated, *"CDA provides detailed, actionable approaches to individual learning. Different milestones are considered or taken as important, not the whole concept"* (P7PU). This perspective fundamentally challenges the reductionist tendencies of traditional assessment, which *"only generalises learners' performance based on the marks/grade they got"* (P8PU).

These findings are visually synthesised in Figure 4.20, which delineates CDA's perceived advantages in delivering deeper diagnostic insights and individualised learning support. The schematic representation confirms CDA's dual role as both evaluative instrument and instructional guide, highlighting its capacity to bridge the persistent divide between assessment and pedagogy in contemporary educational practice.

The study contributes to ongoing scholarly discourse by empirically validating teachers' perceptions of CDA's transformative potential. These insights carry significant implications for assessment reform, suggesting that widespread adoption of diagnostic approaches may represent a critical step towards more equitable and effective pedagogical practices. The evidence underscores the necessity of moving beyond conventional assessment paradigms that privilege quantification over understanding, towards models that prioritise meaningful diagnosis and individualised learning progression.



Figure 4.20 Deeper diagnostics insight and individualized learning support

Timely, Formative Feedback for Improved Instruction and Learning Outcomes

This thematic analysis elucidates the transformative capacity of Cognitive Diagnostic Assessment (CDA) to generate dynamic, formative feedback that actively shapes instructional practices and enhances learning outcomes. The findings reveal a fundamental distinction between CDA's process-oriented approach and the static, summative nature of traditional assessment methodologies. Participants consistently emphasised CDA's role in fostering critical learner engagement and metacognitive reflection during the learning process itself, as exemplified by the observation that *"CDA is very good and more effective as opposed to traditional assessment, because it allows learners to express themselves critically"* (P1PU).

The temporal dimension of CDA emerges as particularly salient, with the framework enabling real-time identification of learning obstacles and consequent pedagogical adjustments. This

diagnostic immediacy facilitates precisely targeted individual support, creating a responsive feedback loop between assessment and instruction. In stark contrast, traditional assessments were characterised as fundamentally retrospective and reductionist, with one participant noting their primary concern was determining *"who would be the best scorer and how many passed, and how many failed"* (P2U). Such normative comparisons were perceived as offering limited utility for meaningful pedagogical intervention.

Participants particularly valued CDA's formative orientation, with one educator highlighting its superiority for *"ongoing feedback and guiding instruction"*, while noting that traditional assessments, though useful for summative grading, *"often come too late to intervene meaningfully"* (P4U). This temporal advantage was further elaborated through the contrast between CDA's focus on *"learning improvement of each learner"* through in-process diagnosis, versus traditional methods that primarily *"focus on how the class is performing because it compares learners by positioning them"* (P5U).

These comparative insights position CDA as both a diagnostic instrument and a pedagogical catalyst, providing actionable intelligence that informs continuous instructional refinement. The framework's capacity to illuminate the learning process in real-time represents a significant advancement over conventional assessment paradigms that merely document outcomes.

These conceptual distinctions are systematically presented in Figure 4.21, which contrasts CDA's formative feedback mechanisms with traditional assessment approaches. The schematic representation underscores how CDA's real-time diagnostic capabilities create opportunities for proactive pedagogical intervention throughout the learning journey, rather than merely evaluating its endpoint.

The study contributes to contemporary assessment discourse by empirically validating CDA's potential to bridge the persistent gap between evaluation and instruction. These findings suggest that widespread adoption of diagnostic assessment methodologies could fundamentally reconfigure educational practices, shifting emphasis from comparative ranking to individual growth and from terminal judgement to continuous improvement. The evidence underscores the necessity of developing assessment frameworks that prioritise pedagogical utility over mere quantification, particularly in contexts where meaningful learning progression is the primary objective.

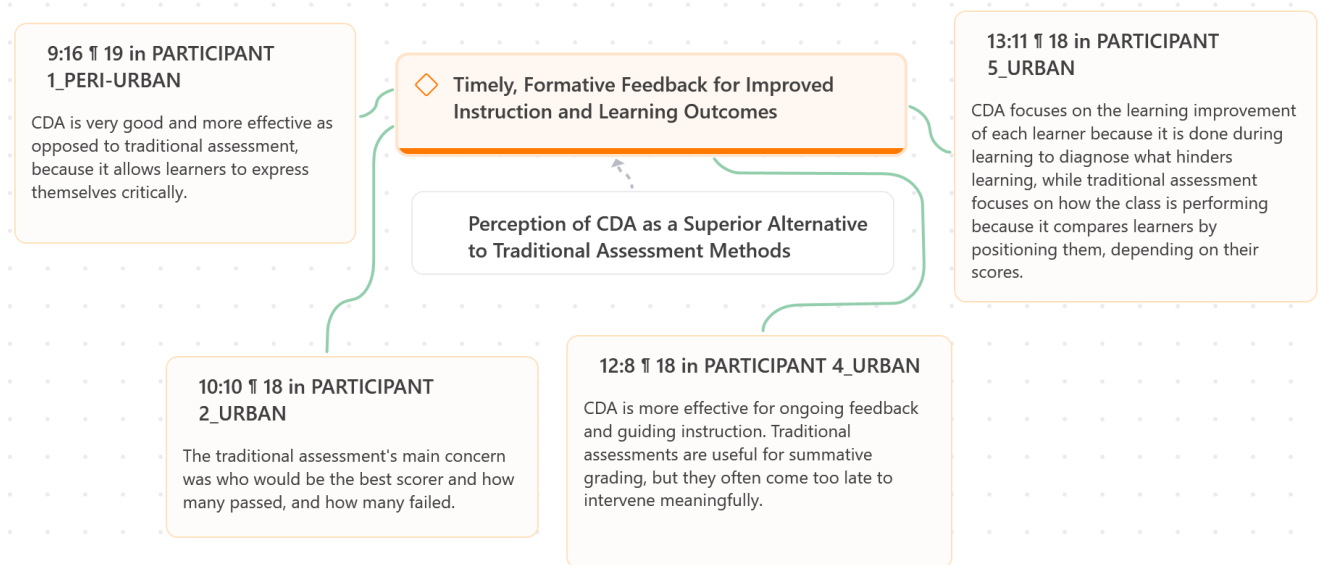


Figure 4. 21 *Timely, formative feedback for improved instruction and learning outcomes*

CDA AS A TRANSFORMATIVE TOOL FOR RESPONSIVE AND INFORMED

This thematic analysis reveals the profound reconceptualisation of assessment methodologies precipitated by the implementation of Cognitive Diagnostic Assessment (CDA) in modern educational contexts. The findings demonstrate that CDA has fundamentally altered teachers' approaches to classroom evaluation, displacing traditional summative paradigms with a dynamic framework that privileges diagnostic precision and pedagogical responsiveness. Practitioners consistently characterise CDA as an empowering instrument that facilitates the development of sophisticated assessment strategies capable of yielding nuanced insights into learners' cognitive architectures.

The diagnostic acuity afforded by CDA informs a recursive instructional cycle wherein assessment and pedagogy become symbiotically intertwined, fostering an organic relationship between evaluation and educational progression. Teachers report that the framework enables them to formulate purposefully designed, cognitively demanding questions that probe beyond superficial understanding to reveal the underlying mechanisms of knowledge construction. This represents a significant advancement from conventional evaluation practices, which typically emphasise breadth over depth in their assessment of learner competence.

Simultaneously, the diagnostic intelligence generated through CDA facilitates the development of precisely calibrated pedagogical interventions tailored to learners' specific cognitive profiles. This personalised approach transcends the limitations of standardised instruction by accommodating heterogeneous learning trajectories while optimising educational outcomes. The framework's capacity to illuminate the learning process in real-time supports a responsive teaching methodology wherein instructional decisions are continuously informed by empirical evidence of learner development.

These transformative effects are visually synthesised in Figure 4.22, which captures teachers' perceptions of CDA as a catalyst for responsive, informed assessment practices. The schematic representation illustrates how the framework reconfigures traditional assessment paradigms, positioning evaluation not as a terminal judgement but as an integral component of the learning process itself.

The study makes a substantive contribution to contemporary educational discourse by empirically validating CDA's role in bridging the persistent dichotomy between assessment and instruction. The findings suggest that widespread adoption of diagnostic assessment methodologies could herald a new era in pedagogical practice characterised by enhanced precision, adaptability and learner-centred focus. More significantly, the evidence points towards a fundamental reimagining of the relationship between evaluation, teaching and learning in twenty-first century education, with profound implications for curriculum design, teacher professional development and educational policy formulation.

Ultimately, this investigation positions CDA not merely as an assessment innovation, but as a transformative pedagogical tool capable of reshaping educational practice at both micro-level classroom interactions and macro-level systemic approaches to teaching and learning. The framework's dual capacity to generate sophisticated diagnostic insights while informing responsive instructional strategies marks a significant advancement in the field of educational assessment, with far-reaching consequences for the optimisation of learning outcomes across diverse educational contexts.



Figure 4. 22 CDA as a transformative tool for responsive and informed assessment practices

Enhanced Questioning and Depth in Assessment Strategies

This sub-theme illustrates how Cognitive Diagnostic Assessment (CDA) cultivates sophisticated questioning strategies that promote deeper cognitive engagement and conceptual understanding. The findings reveal that CDA provides teachers with a diagnostic framework to design questions that are precisely aligned with both learning objectives and individual learners' cognitive profiles.

Participants consistently reported that CDA enhances their capacity to formulate questions that target specific skills while accommodating varying levels of understanding. As one teacher articulated, *"it enables teachers to know when to employ high-order questions per skill, as they will have a better knowledge of the depth of strengths and weaknesses of individuals"* (P2U). This diagnostic precision allows for the strategic deployment of questions that scaffold understanding while challenging learners appropriately.

The spiral nature of CDA-informed questioning emerges as particularly significant, with one teacher describing how the approach *"enhances my assessment practices by helping me to ask questions spirally"* and *"get deeper into the concept that I am teaching"* (P3U). This iterative questioning technique, informed by continuous diagnostic insights, enables teachers to probe conceptual understanding at progressively deeper levels while maintaining alignment with learners' developmental trajectories.

Furthermore, participants emphasised how CDA fosters questioning strategies that stimulate higher-order thinking. The framework encourages questions that *"encourage learners to think critically and even elaborate more"* (P3U), thereby promoting metacognitive awareness and

knowledge construction. This represents a marked departure from conventional assessment practices that often prioritise factual recall over deeper cognitive engagement.

The diagnostic specificity of CDA also enables teachers to identify precise areas requiring intervention, as noted by one participant: *"allows me to realize specific learning gaps as it emphasizes pinpointing the specific areas where learners have problems"* (P6PU). This granular understanding informs the development of questions that target identified gaps while building on existing competencies.

These transformative effects on questioning practices are systematically presented in Figure 4.23, which illustrates how CDA has enhanced both the depth and diagnostic utility of teachers' assessment strategies. The visual representation captures the framework's role in fostering questioning techniques that are simultaneously more purposeful, differentiated and cognitively challenging.

Inclusively, these findings demonstrate that CDA transcends conventional assessment approaches by transforming questioning into a dynamic diagnostic tool. Rather than serving merely as an evaluative mechanism, questioning becomes an integral component of the learning process itself - one that is continuously refined through empirical insights into learners' understanding. This represents a significant advancement in formative assessment practice, with important implications for the development of critical thinking skills and conceptual mastery.

The study contributes to contemporary pedagogical discourse by empirically validating CDA's capacity to enhance questioning as both an art and a science. By grounding questioning strategies in diagnostic evidence, CDA enables educators to achieve an optimal balance between challenge and support, ultimately fostering more robust and durable learning outcomes. These findings suggest that the strategic integration of diagnostic assessment methodologies could represent a critical step forward in the evolution of classroom questioning practices.

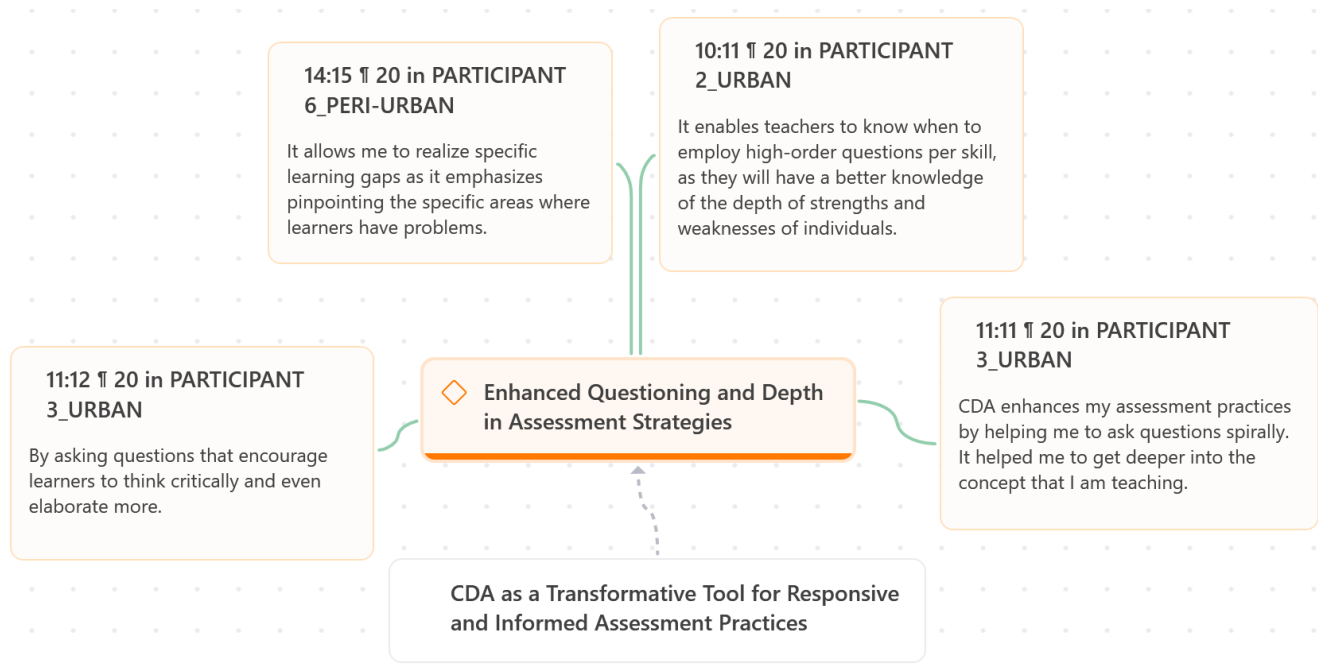


Figure 4.23 *Enhanced questioning and depth in assessment strategies*

Informed and Individualised Instructional Planning

This sub-theme explicates the profound capacity of Cognitive Diagnostic Assessment (CDA) to revolutionise instructional design through its sophisticated diagnostic mechanisms. The findings reveal that CDA facilitates a paradigmatic shift from standardised pedagogical approaches to meticulously tailored educational strategies that respond to learners' distinct cognitive architectures.

Participants articulated how CDA's diagnostic precision enables a departure from conventional, undifferentiated teaching methods towards truly learner-centric pedagogies. As one educator poignantly reflected, *"knowing my learners' needs helped me to structure my lessons in a way that addressed them, unlike in the past, when I did not know about CDA"* (P1PU), further noting the transformative impact on planning: *"I now plan individualised lessons so that I can address those individual needs"* (P1PU). This metamorphosis in instructional approach was consistently echoed across participant accounts, with practitioners emphasising CDA's role in facilitating bespoke teaching strategies that *"help me to tailor instruction to students' needs"* (P4U) and *"enable me to know how to assess learners based on their learning styles that I diagnosed"* (P5U).

The diagnostic intelligence generated through CDA was particularly valued for its granularity and pedagogical utility. Participants highlighted the framework's capacity to provide *"detailed, useful feedback"* (P6PU) that yields *"a clear direction on how I am going to help an individual learner in class"* (P6PU). This formative feedback loop, distinguished by its specificity and actionability, was further characterised as offering *"detailed and helpful feedback on learners' strengths and weaknesses"* (P7PU), thereby serving as both an evaluative mechanism and an instructional compass.

The culmination of these diagnostic insights' manifests in sophisticated differentiated instruction, empowering teachers to *"identify my learners' strengths and weaknesses so that I can assess them accordingly"* and discern *"where they struggle"* (P8PU). This represents a significant advancement in pedagogical practice, wherein assessment-derived intelligence directly informs the development of precisely calibrated teaching interventions.

These transformative effects on instructional planning are systematically presented in Figure 4.24, which delineates teachers' perceptions of CDA's role in fostering informed, individualised pedagogy. The schematic representation captures the framework's capacity to bridge diagnostic assessment with responsive teaching strategies, creating a dynamic interplay between evaluation and instruction.

The study makes a substantive contribution to contemporary educational discourse by empirically validating CDA's role in advancing personalised learning paradigms. These findings suggest that the integration of diagnostic assessment methodologies represents a critical evolution in pedagogical practice - one that prioritises cognitive responsiveness over curricular standardisation. The implications extend beyond classroom practice to inform broader conversations about educational equity, suggesting that CDA may serve as a powerful tool in addressing diverse learning needs within heterogeneous educational environments.

Resultantly, this investigation positions CDA not merely as an assessment innovation, but as a catalyst for a fundamental reimagining of teacher-student interactions. By transforming diagnostic insights into pedagogical action, CDA emerges as a sophisticated mechanism for actualising the principles of differentiated instruction, with profound implications for both individual learning trajectories and systemic educational improvement.



Figure 4. 24 Informed and individualized instructional planning

USING CDA TO REVEAL LEARNER-SPECIFIC COGNITIVE PATTERNS AND INSTRUCTIONAL NEEDS

This thematic analysis reveals how Cognitive Diagnostic Assessment (CDA) serves as a sophisticated analytical framework that enables teachers to develop profound insights into the underlying architecture of student cognition. The findings demonstrate that CDA moves beyond conventional assessment paradigms focused on superficial performance metrics, instead providing teachers with a powerful diagnostic mechanism to examine not just what students know, but how they structure knowledge and where precisely their understanding demonstrates fragility or robustness.

Through its systematic implementation, CDA facilitates a fundamental shift in pedagogical approach, allowing educators to transition from outcome measurement to process-oriented

evaluation. This transformation empowers teachers to develop precisely targeted interventions that address root causes of learning difficulties while simultaneously identifying and building upon existing cognitive strengths. The framework's diagnostic precision reveals specific loci of conceptual misunderstanding and procedural deficiency that might otherwise remain obscured in traditional assessment regimes.

Concurrently, CDA's analytical capabilities highlight islands of competence and areas of skill mastery, providing equally valuable diagnostic information. This dual capacity to identify both learning obstacles and competencies enables teachers to scaffold new knowledge upon robust existing structures while implementing strategic interventions for conceptual gaps. The framework thus transforms assessment from a blunt evaluative instrument into a precision diagnostic tool that actively informs differentiated pedagogy.

These insights are visually synthesised in Figure 4.25, which illustrates CDA's capacity to reveal learners' specific cognitive patterns and consequent instructional requirements. The schematic representation captures the framework's role in creating a dynamic interplay between assessment and instruction, where diagnostic findings directly shape pedagogical responses.

The study makes a substantive contribution to contemporary educational research by empirically validating CDA's potential to enhance both the precision and efficacy of classroom practice. In contexts of heterogeneous learner preparedness, the framework provides the empirical foundation necessary to genuinely differentiate instruction while maintaining rigorous academic standards. The implications extend beyond immediate classroom applications to inform broader theoretical debates about educational equity and personalised learning.

In sum, this analysis positions CDA as both a microscope revealing the fine structure of learning and a compass guiding pedagogical navigation. By making visible the varied cognitive landscapes within learning cohorts, the framework facilitates a more nuanced understanding of student development that transcends traditional assessment limitations. The findings suggest that widespread adoption of diagnostic approaches could fundamentally reshape educational practice, fostering teaching methodologies that are simultaneously more responsive to individual needs and more effective in promoting durable learning outcomes.

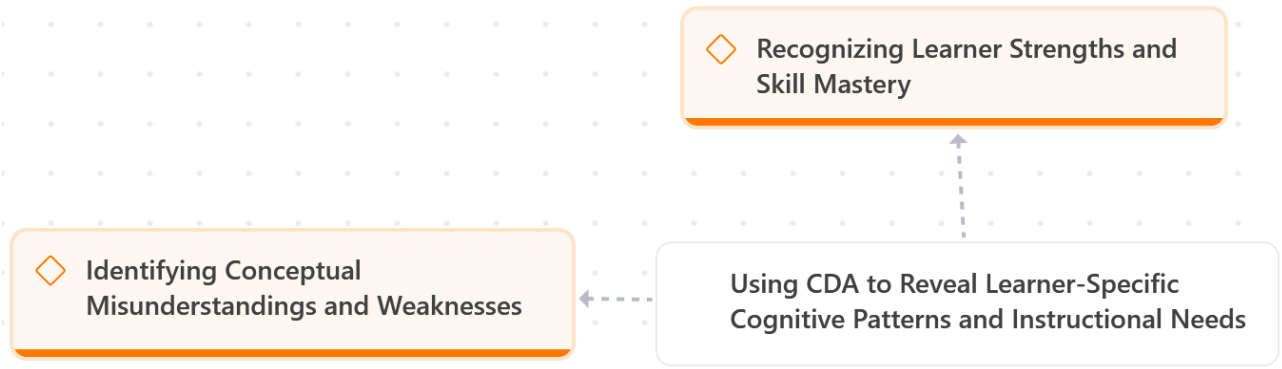


Figure 4.25 Using CDA to reveal learner-specific cognitive patterns and instructional needs

Identifying Conceptual Misunderstandings and Weaknesses

This sub-theme demonstrates how Cognitive Diagnostic Assessment (CDA) serves as an indispensable analytical instrument, enabling educators to identify and address specific learning deficiencies with unprecedented precision. The findings reveal that CDA transcends conventional assessment approaches by elucidating not merely the existence of learning difficulties, but their exact cognitive loci and underlying causes.

Teachers' accounts illustrate CDA's capacity to reveal nuanced mathematical misconceptions that might otherwise remain obscured. One participant's observation that certain learners "*confused multiplication with addition*" while manipulating fractions ("*As I was marking, I realized that some learners were able to add and subtract fractions with the same denominator, while others found it difficult to multiply*" – (P1PU) exemplifies the framework's diagnostic acuity. Similarly, the persistent failure to properly convert temporal units - evidenced by responses such as *"20 minutes/1 hour"* (P3U) - exposed fundamental gaps in understanding measurement relationships that standard assessments might overlook.

In literacy instruction, CDA proved equally revelatory, uncovering foundational deficits in phonological processing that necessitated curricular recalibration. As one teacher noted upon discovering students' decoding difficulties: "*They were unable to do that. That was when I realized that I had to make a curricular adjustment by going back to teach them the letters and word decoding*" (P5U). This capacity to prompt timely pedagogical intervention underscores CDA's formative utility.

The framework's predictive value emerges particularly in pre-instructional diagnostics, as when a mathematics teacher identified widespread misconceptions regarding fraction operations before commencing a new unit (P6PU). Across disciplines - from scientific terminology (P7PU) to English verb morphology ("*Some were saying blowed... while others got it correct as blew*") (P8PU) - CDA consistently provided the granular insights necessary for targeted remediation.

These diagnostic capabilities are systematically presented in Figure 4.26, which synthesises educators' experiences in leveraging CDA to uncover conceptual misunderstandings. The visual representation highlights the framework's role in transforming assessment from a summative judgment into a dynamic process of cognitive mapping.

The study contributes significantly to pedagogical scholarship by empirically validating CDA's capacity to bridge the diagnostic-prescriptive gap in education. By illuminating the specific architecture of student misunderstandings, the framework enables a precision approach to remediation that addresses root causes rather than symptoms of learning difficulties. These findings carry important implications for both classroom practice and teacher professional development, suggesting that diagnostic assessment literacy should constitute a core competency in contemporary teacher preparation programmes.

Altogether, this analysis positions CDA as more than an assessment tool - it emerges as an essential mechanism for realising the principles of responsive, evidence-based pedagogy. In an educational landscape increasingly focused on personalised learning, the framework's capacity to reveal and remedy individual cognitive gaps represents a critical advancement in the pursuit of equitable, effective instruction.

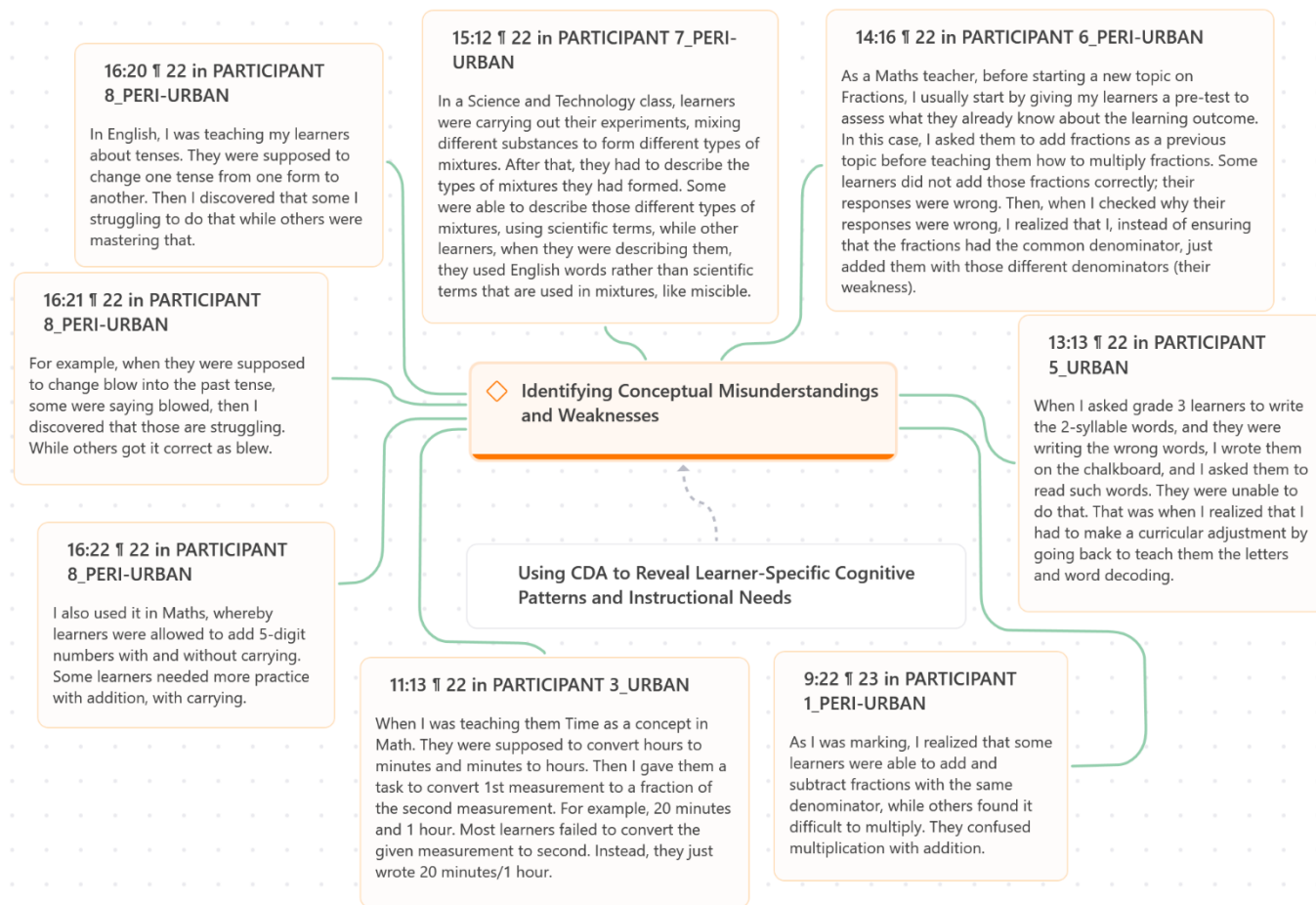


Figure 4.26 Identifying conceptual misunderstandings and weaknesses

Recognising Learner Strengths and Skill Mastery

This analysis demonstrates how Cognitive Diagnostic Assessment (CDA) functions as a sophisticated diagnostic tool that simultaneously reveals learner competencies alongside areas requiring development, thereby enabling more nuanced and effective pedagogical interventions. The findings illustrate that CDA provides teachers with a multidimensional perspective on student understanding, moving beyond binary judgements of correctness to uncover the complex cognitive architectures underlying both proficiency and difficulty.

Participant accounts consistently highlight CDA's capacity to identify specific mathematical competencies even within challenging conceptual domains. As one teacher observed, "*CDA had helped me when I was teaching my learners to add, subtract, and multiply fractions with the same denominator*" (P1PU), suggesting the framework's utility in pinpointing precise areas of operational fluency. Similarly, another educator's reflection on surface area calculations "*I noticed*

that my students can only calculate areas of a few surfaces (strength), but forget to add all the totals of calculated surfaces together" (P2U) exemplifies how CDA exposes both procedural mastery and conceptual oversight within singular mathematical operations.

In linguistic domains, the diagnostic precision of CDA proves equally valuable. One teacher's analysis of writing samples revealed that while students demonstrated lexical proficiency ("*strong vocabulary*"), they simultaneously struggled with textual organisation ("*paragraph structure*" – P4U). This bifocal insight enables teachers to design interventions that remediate weaknesses while strategically leveraging existing strengths. The framework's capacity to identify latent competencies is further evidenced by a teacher's observation that "*though their responses were wrong, they were able to simplify their answers (their strengths)*" (P6PU), demonstrating CDA's ability to uncover productive cognitive processes even within incorrect solutions.

These findings collectively position CDA as more than a deficiency-identification mechanism - it emerges as a balanced diagnostic approach that recognises and cultivates learner capabilities while addressing specific gaps. This dual focus facilitates strength-based pedagogical strategies that build upon existing competencies to scaffold more challenging material, thereby optimising both learning efficacy and student confidence.

The comprehensive insights generated through CDA are systematically presented in Figure 4.27, which visually synthesises educators' experiences in identifying and utilising learner strengths through diagnostic assessment. The schematic representation captures the framework's role in fostering a more holistic understanding of student capabilities that informs differentiated instruction.

This study makes a substantive contribution to educational assessment literature by empirically validating CDA's unique capacity to provide balanced diagnostic intelligence. In contrast to traditional assessment paradigms that often emphasise deficit identification, CDA offers a more nuanced approach that acknowledges and builds upon learner strengths while precisely targeting areas for development. The implications suggest that widespread adoption of such diagnostic methodologies could significantly enhance the effectiveness of differentiated instruction, particularly in heterogeneous classrooms where understanding individual learning profiles is paramount.

In totality, the analysis emphasises CDA's transformative potential in redefining assessment as a constructive, rather than purely evaluative, pedagogical tool. By illuminating both the robust and

fragile elements of student understanding, the framework enables teaching strategies that are simultaneously more responsive to individual needs and more effective in promoting comprehensive mastery. These findings advocate for the integration of diagnostic assessment approaches that value and utilise learner strengths as foundational elements in the educational process.

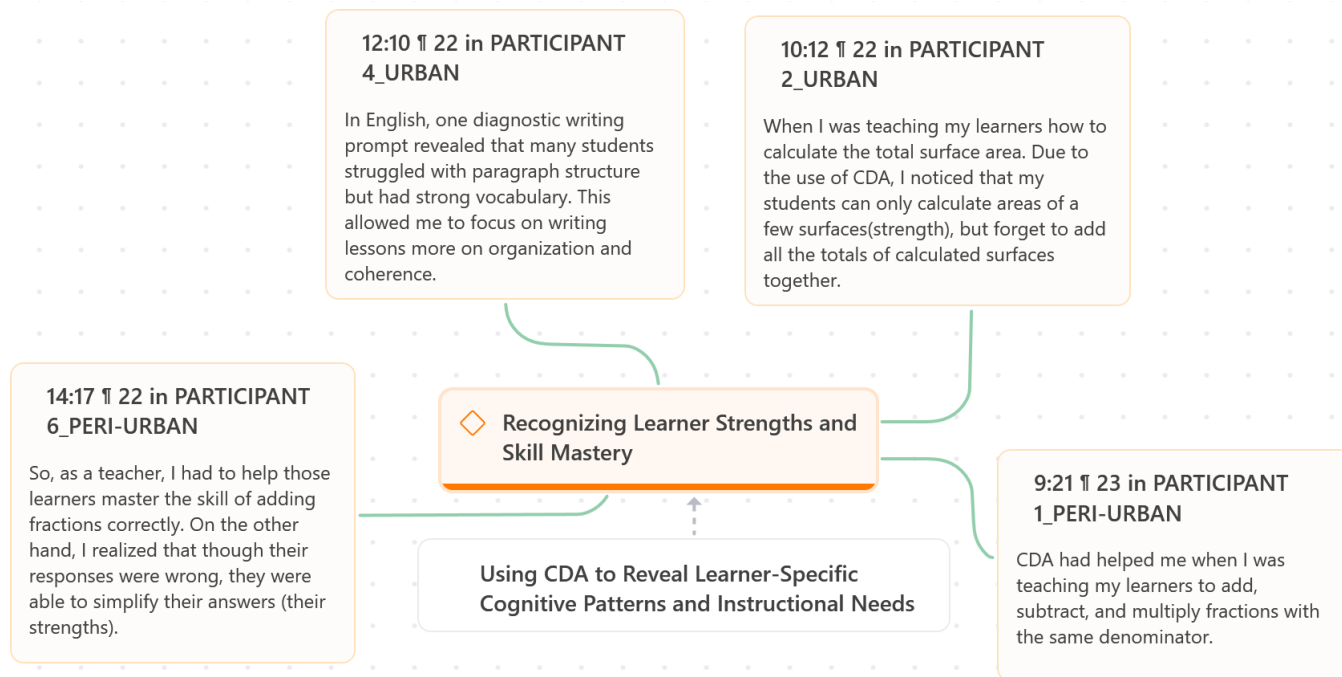


Figure 4. 27: Recognizing learners' strengths and skill mastery

CDA AS A CATALYST FOR DEEP CONCEPTUAL UNDERSTANDING AND LEARNER GROWTH

This thematic analysis clarify how Cognitive Diagnostic Assessment (CDA) serves as a transformative mechanism in contemporary education, fostering substantive intellectual engagement while enabling precisely tailored pedagogical interventions. The findings reveal that CDA facilitates a fundamental shift from superficial knowledge acquisition to deep conceptual understanding, positioning assessment as an integral component of the learning process itself rather than merely its endpoint.

Teachers consistently reported that CDA-designed tasks require learners to engage in higher-order cognitive processes, moving beyond rote memorisation to authentic knowledge application. This pedagogical approach cultivates analytical reasoning skills and metacognitive awareness as

students articulate their thought processes and apply concepts to novel, real-world contexts. Such intellectually demanding tasks stand in stark contrast to conventional assessment methods that often prioritise factual recall over genuine understanding, thereby promoting the development of transferable critical thinking competencies.

Simultaneously, the diagnostic precision inherent in CDA provides teachers with nuanced insights into individual learning trajectories. This granular understanding enables the implementation of truly differentiated instruction, where teaching strategies are continuously adapted to address specific conceptual hurdles while building upon demonstrated strengths. The framework creates a dynamic feedback loop wherein assessment data directly informs instructional adjustments, ensuring all learners receive appropriately challenging material alongside targeted support.

These dual dimensions of CDA's impact - fostering deep cognitive engagement while facilitating personalised learning pathways - are visually synthesised in Figure 4.28. The schematic representation captures the framework's capacity to function simultaneously as a catalyst for conceptual understanding and a blueprint for differentiated instruction.

The study makes a substantive contribution to educational scholarship by empirically validating CDA's role in bridging the persistent divide between assessment practices and meaningful learning outcomes. These findings suggest that the framework's diagnostic-prescriptive cycle creates optimal conditions for developing both subject-specific mastery and transferable intellectual skills. The implications extend beyond immediate classroom applications to inform broader pedagogical discourse, positioning assessment-integrated teaching approaches as critical to realising the goals of twenty-first century education.

In the end, this analysis reconceptualises CDA as a comprehensive pedagogical system rather than merely an evaluative tool. By aligning assessment with the principles of deep learning and responsive instruction, the framework offers a theoretically robust and empirically validated model for educational practice. The evidence underscores the transformative potential of diagnostic assessment methodologies in cultivating intellectually engaged, autonomous learners while equipping teachers with the insights necessary for precision teaching. This dual focus on cognitive challenge and individualised support represents a significant advancement in pedagogical practice, with far-reaching implications for educational quality and equity.

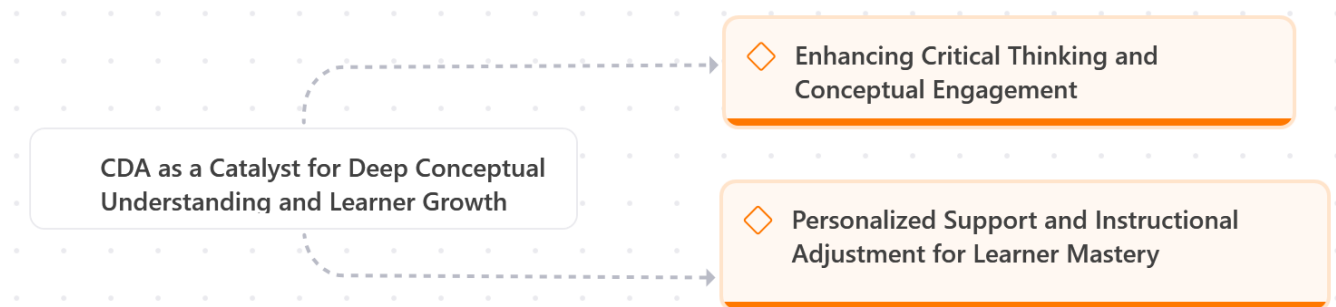


Figure 4. 28 CDA as a catalyst for deep conceptual understanding and learner growth

Enhancing Critical Thinking and Conceptual Engagement

This theme annotates the substantive role of Cognitive Diagnostic Assessment (CDA) in cultivating advanced cognitive skills and promoting profound subject-matter understanding. The findings demonstrate that CDA serves as a pedagogical mechanism that systematically elevates learners beyond superficial knowledge acquisition to sophisticated intellectual engagement.

Participants consistently reported that CDA-designed tasks necessitate analytical reasoning and authentic knowledge application, thereby displacing rote memorisation as the dominant learning strategy. As one teacher succinctly observed, *"it will promote deeper understanding"* (P1PU), capturing the framework's fundamental capacity to foster meaningful cognitive engagement. This transformative effect manifests particularly in applied contexts, exemplified by a teacher's account of financial literacy development: *"CDA tests how one can solve problems. So, in 'Addition of money' in the buying and selling program, learners were able to sell, correctly collecting the amount expected, and also buy different items at a go, giving the seller the accurate amount"* (P2U). Such practical applications not only validate conceptual understanding but also cultivate transferable competencies, as evidenced by the subsequent development of *"critical thinking"* and improved cognitive *"speed"* (P2U).

The framework's distinctive emphasis on metacognitive articulation emerges as particularly significant. Teachers emphasised that *"CDA tasks require students to explain thinking, solve real-life problems, or justify answers, which deepens conceptual understanding instead of memorization"* (P4U). This requirement for explicit reasoning transforms assessment from a

passive demonstration of knowledge to an active construction of understanding, ultimately producing *"learners who can think critically and solve problems"* (P5U).

These pedagogical outcomes are systematically represented in Figure 4.29, which illustrates teachers' perceptions of CDA's impact on critical thinking development and conceptual engagement. The visual schema captures the framework's dual capacity to both evaluate and enhance higher-order cognitive skills through its unique assessment design.

The study makes a substantive contribution to educational theory by empirically validating CDA's role in operationalising the principles of deep learning. These findings suggest that the framework's integration of diagnostic assessment with cognitive challenge creates optimal conditions for developing the analytical and problem-solving skills essential for academic and real-world success. The implications extend beyond assessment methodology to inform broader pedagogical practice, highlighting the importance of designing learning experiences that simultaneously evaluate and cultivate sophisticated intellectual competencies.

Forthwith, this analysis positions CDA as more than an evaluative instrument - it emerges as a sophisticated pedagogical intervention that reconfigures the relationship between assessment and cognitive development. By embedding critical thinking requirements within diagnostic evaluation, the framework ensures that intellectual growth becomes an inherent outcome of the assessment process itself, rather than merely its prerequisite. This innovative approach represents a significant advancement in educational practice, with profound implications for cultivating the adaptable, analytical minds required in contemporary society.

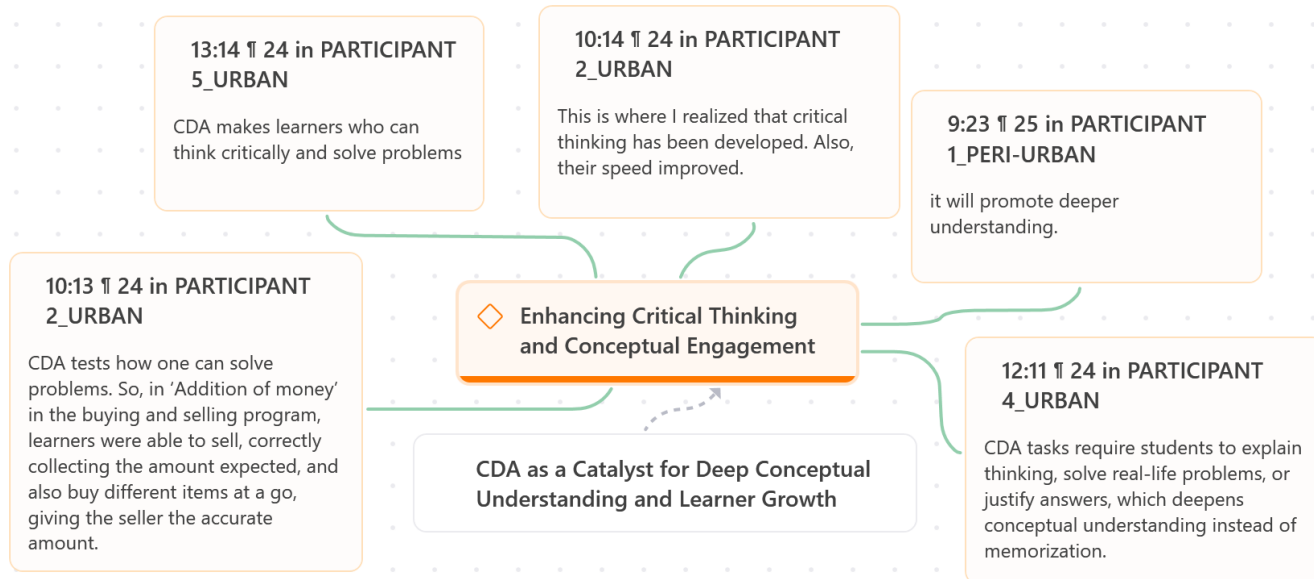


Figure 4.29 Enhancing critical thinking and conceptual engagement

Personalised Support and Instructional Adjustment for Learner Mastery

This theme clarifies how Cognitive Diagnostic Assessment (CDA) serves as a sophisticated diagnostic framework that enables teachers to implement precisely calibrated instructional strategies tailored to individual learning trajectories. The findings demonstrate that CDA provides teachers with the empirical foundation necessary to transcend conventional one-size-fits-all pedagogies in favour of responsive, evidence-based differentiation.

Participants consistently reported that CDA's diagnostic precision facilitates a nuanced understanding of learners' cognitive profiles, allowing for strategic pedagogical adjustments. As one educator explained, "*learners are approached according to their level of understanding using appropriate techniques*" (P3U), highlighting the framework's role in informing differentiated instructional approaches. This adaptive teaching methodology frequently incorporates targeted repetition and reinforcement, with another participant noting "*concepts that the learner did not grasp are repeated during extra classes. Repeating them frequently improves student understanding*" (P3U).

The framework's capacity to identify specific learning deficiencies emerged as particularly transformative, enabling precisely focused remedial interventions. One teacher emphasised how "*it gives me the ability to discover the students' learning gaps, I can be able to support every*

student to achieve their full potential. This can be done by using remedials..." (P6PU), while another affirmed "It is through the remedials that I am going to help learners more in those areas where they struggle..." (P6PU). Such targeted support ensures that "crucial skills for mastery or completion of certain topics or concepts are catered for" (P7PU), creating equitable pathways to subject proficiency.

The temporal flexibility afforded by CDA proves equally significant, as evidenced by the observation that *"CDA contributes by allowing unable learners to catch up by repeating lessons (especially where they struggle)" (P8PU). This adaptive pacing mechanism acknowledges variable learning rates while maintaining consistent mastery expectations.*

These pedagogical adaptations are systematically presented in Figure 4.30, which delineates educators' implementation of personalised support strategies informed by CDA insights. The visual representation captures the framework's role in transforming diagnostic data into differentiated instructional practices.

The study makes a substantive contribution to inclusive education discourse by empirically validating CDA's capacity to operationalise the principles of responsive pedagogy. These findings suggest that the framework's diagnostic-prescriptive cycle creates optimal conditions for realising equitable learning outcomes in heterogeneous classrooms. The implications extend beyond immediate classroom practice to inform broader conversations about educational justice, highlighting how assessment-informed differentiation can serve as a powerful mechanism for addressing achievement disparities.

In this analysis CDA is positioned as both a diagnostic instrument and a pedagogical compass, guiding teachers in navigating diverse learning needs while maintaining rigorous academic standards. By transforming assessment data into actionable instructional intelligence, the framework represents a significant advancement in the pursuit of truly personalised, mastery-oriented education.

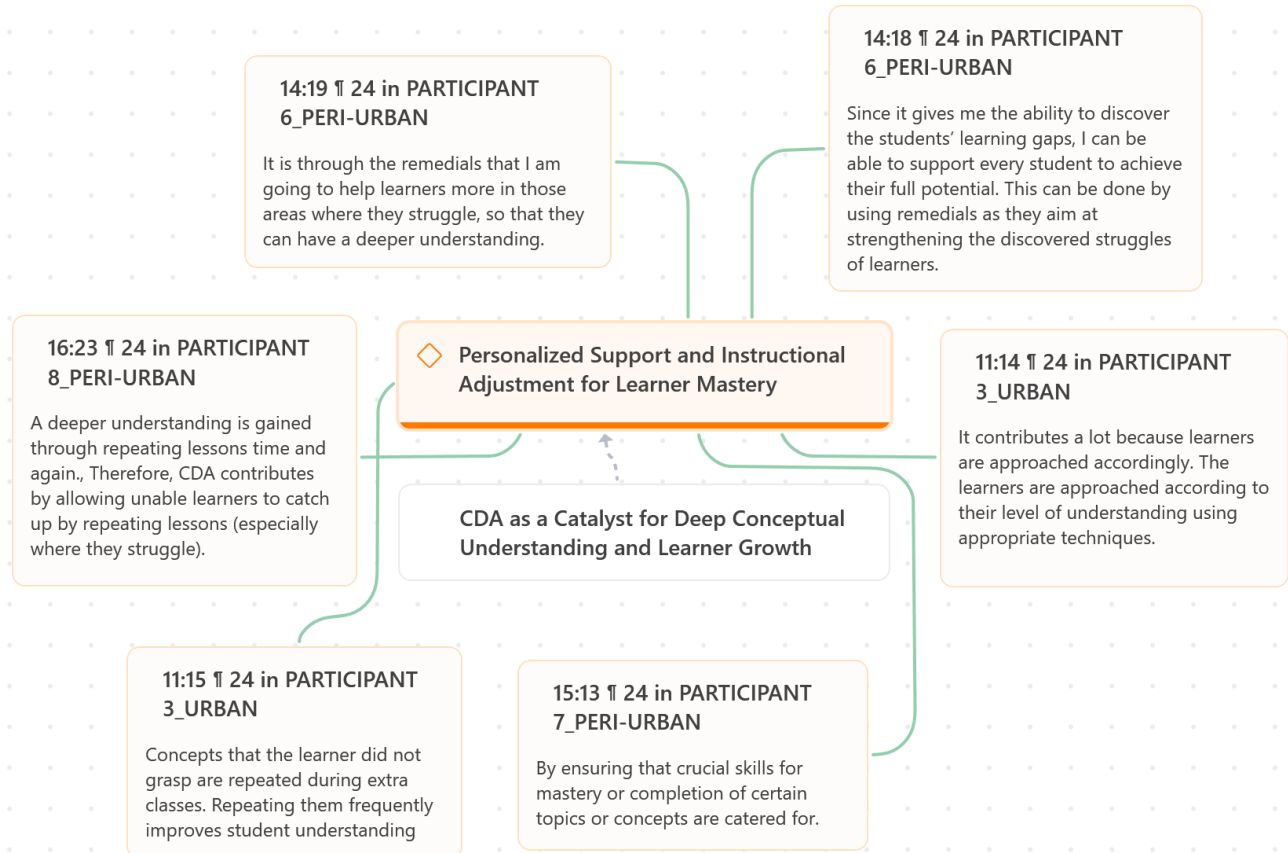


Figure 4.30 Personalised support and instructional adjustment for learner mastery

BENEFITS OF CDA FOR INFORMED, TARGETED, AND RESPONSIVE INSTRUCTION

This thematic analysis elucidates educators' perceptions of how Cognitive Diagnostic Assessment (CDA) serves as a powerful mechanism for optimising instructional effectiveness through its capacity to generate nuanced insights into learner competencies. The findings reveal that CDA operates as both a diagnostic instrument and pedagogical compass, fundamentally reshaping classroom practice through three interconnected dimensions of professional enhancement.

The first dimension, *Improved Engagement and Learner Empowerment*, captures how CDA's transparent assessment framework cultivates heightened student participation and ownership of the learning process. Teachers observed that the diagnostic clarity provided by CDA motivates learners to engage more actively with subject matter, as they develop metacognitive awareness of their own learning trajectories. This empowerment effect stems from CDA's capacity to make

learning progression visible and comprehensible to students, thereby fostering intrinsic motivation and self-regulated learning behaviours.

Within the second dimension, *Informed Lesson Planning and Instructional Alignment*, participants emphasised how CDA's diagnostic precision informs more intentional curriculum design. Teachers reported leveraging assessment data to construct purposefully sequenced lessons that address identified learning needs while building upon demonstrated strengths. This evidence-based approach to pedagogical planning represents a significant departure from conventional, assumption-driven preparation, ensuring optimal alignment between instructional objectives and learner readiness.

The third dimension, *Tailored Instruction and Responsive Support*, highlights CDA's role in facilitating precisely calibrated classroom interventions. Teachers consistently described how diagnostic insights enable them to implement differentiated strategies in real-time, providing targeted support that addresses specific conceptual difficulties while challenging areas of proficiency. This adaptive teaching methodology exemplifies the framework's capacity to transform static assessment data into dynamic pedagogical action.

These transformative benefits are systematically presented in Figure 4.31, which visually synthesises CDA's multifaceted contributions to instructional practice. The schematic representation delineates three core advantages: (1) the facilitation of informed lesson planning through robust instructional alignment; (2) the generation of diagnostic insights that enable tailored instruction; and (3) the cultivation of improved engagement leading to learner empowerment.

The study makes a substantive contribution to educational scholarship by empirically validating CDA's potential to bridge the persistent divide between assessment and instruction. These findings suggest that the framework's diagnostic-prescriptive cycle creates optimal conditions for realising the principles of differentiated pedagogy in authentic classroom contexts. The implications extend beyond immediate practice to inform broader conversations about educational effectiveness, positioning data-informed teaching as a critical competency in contemporary pedagogy.

By embedding diagnostic intelligence at the heart of instructional decision-making, the approach represents a significant advancement in the pursuit of truly responsive, learner-centred education. The evidence underscores the transformative potential of assessment-integrated teaching

methodologies in addressing the diverse needs of twenty-first century learners while maintaining rigorous academic standards.

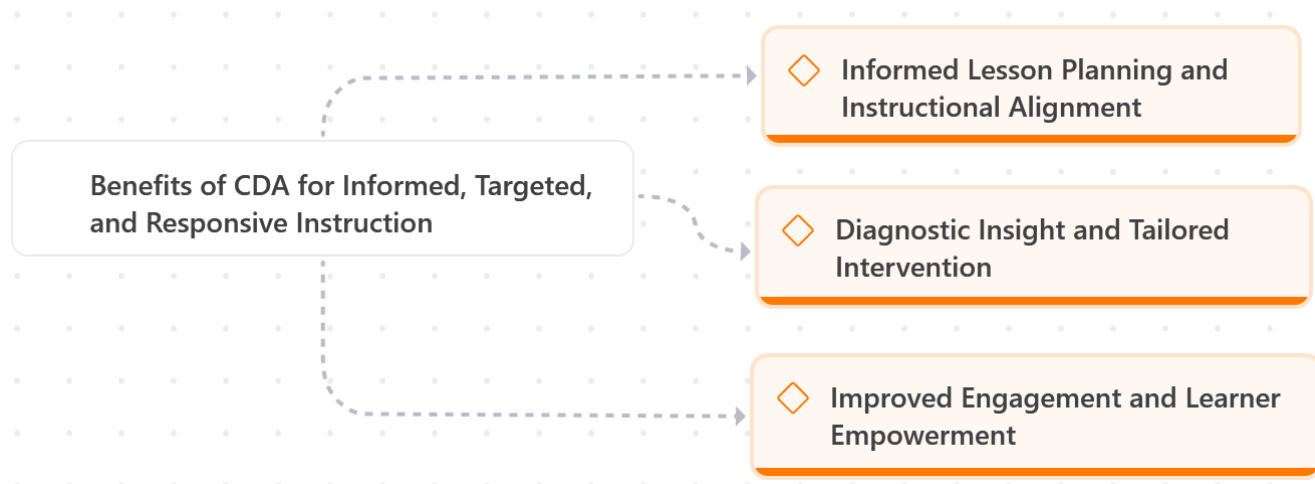


Figure 4. 31 Benefits of CDA for informed, targeted and responsive instruction

Diagnostic Insight and Tailored Intervention

This theme elucidates the fundamental value proposition of Cognitive Diagnostic Assessment (CDA): its systematic capacity to produce granular, operationally meaningful feedback that transforms pedagogical decision-making. The findings reveal that CDA serves as a sophisticated diagnostic instrument, equipping teachers with empirically validated insights to develop precisely calibrated instructional responses tailored to individual learning profiles.

Participants consistently emphasised CDA's dual capacity to identify both areas of proficiency and developmental needs, thereby establishing an evidence base for differentiated intervention strategies. As one educator articulated, *"Since CDA can provide me with detailed feedback about my learners, that helps me to know when I should go the extra mile to help my learners when they are encountering challenges"* (P1PU). This diagnostic precision facilitates data-driven pedagogical adjustments, exemplified by another teacher's observation: *"It helps me to group students by needs, adjust pacing, and revisit misunderstood concepts. It also supports evidence-based intervention rather than guesswork"* (P4U).

The framework's ability to reveal nuanced learning trajectories emerges as particularly significant. Teachers reported that CDA enables them to transcend superficial performance metrics and engage with the complex architecture of student understanding, as evidenced by remarks such as *"With*

CDA, I can identify students' potential and their weaknesses during assessments" (P6PU) and "It helps me to understand what knowledge/skills the learners have gained, what they do not know, and how they can be helped to do better" (P6PU).

A critical finding concerns CDA's bidirectional feedback mechanism, which simultaneously informs teaching strategies while enhancing learner metacognition. One participant highlighted this dual function, noting *"CDA provides both teachers and learners with detailed, specific feedback that illustrates learners' weaknesses and strengths" (P6PU)*. This formative feedback loop translates directly into targeted pedagogical action, as described: *"The detailed feedback helps me to identify where my learners are struggling... even whether I can intervene by providing extra/remedial classes" (P8PU)*.

While acknowledging the temporal investment required - *"learners can now have classes even on weekends" (P8PU)* - participants unanimously affirmed the framework's capacity to promote more equitable learning outcomes through precision support.

These pedagogical transformations are systematically presented in Figure 4.32, which visually synthesizes teachers' experiences in implementing diagnostic-informed, tailored instruction. The schematic representation captures CDA's role in bridging assessment data with differentiated pedagogical action.

The study contributes substantially to educational assessment literature by empirically validating CDA's capacity to operationalise the principles of precision teaching. These findings demonstrate that the framework's diagnostic-prescriptive cycle creates optimal conditions for realising truly responsive pedagogy in diverse classroom contexts. The implications extend beyond immediate practice to inform broader conversations about educational equity, suggesting that assessment-integrated teaching approaches may represent a critical mechanism for addressing persistent achievement gaps.

This analysis repositions CDA from a mere evaluative tool to a comprehensive pedagogical system that embeds diagnostic intelligence at the heart of instructional practice. By transforming assessment data into actionable pedagogical intelligence, the framework represents a significant advancement in the pursuit of empirically validated, learner-centred education that meets the diverse needs of contemporary classrooms while maintaining rigorous academic standards.



Figure 4.32 Diagnostic insight and tailored intervention

This theme elucidates the transformative impact of Cognitive Diagnostic Assessment (CDA) in fostering active learner participation and cultivating intellectual autonomy. The findings demonstrate that CDA serves as a pedagogical catalyst that transcends conventional assessment paradigms by creating dynamic opportunities for cognitive and social engagement within the learning environment.

Participants consistently reported that CDA's interactive framework stimulates substantive discourse and metacognitive development. As one teacher observed, "*CDA improves communication skills as they will be discussing the concept learned. Their skill of judgement, recalling, and organization, either deductively or inductively, will be enhanced*" (P2U). This cognitive engagement is further amplified through the diagnostic process itself, which necessitates active knowledge construction rather than passive reception.

The framework's capacity to strengthen pedagogical relationships emerges as particularly significant. Teachers noted that CDA facilitates more nuanced understanding of individual learners, resulting in qualitatively richer interactions. This is exemplified in the reflection

that *"CDA helped me understand more about learners, hence better engagement with them. It improves learners' performance"* (P3U). Such enhanced mutual understanding creates a virtuous cycle wherein improved diagnostic insight leads to more effective scaffolding, which in turn fosters greater learner confidence and participation.

A critical finding concerns the empowering effect of CDA's immediate feedback mechanisms. The rapid diagnostic-prescriptive cycle enables learners to assume ownership of their developmental trajectory, as captured in the observation that *"Feedback is immediate, and learners improve their work. And the learners are also able to carry on the classroom activities alone sooner after getting the teachers' assistance"* (P5U). This timely reinforcement cultivates self-regulated learning behaviours while reducing dependency on constant teacher direction.

The framework's role in promoting active knowledge construction is further evidenced by participant accounts of increased learner agency. One teacher emphasized that *"It also allows my learners to be actively involved in teaching and learning activities"* (P8PU), highlighting CDA's capacity to transform students from passive recipients to engaged co-constructors of knowledge.

These pedagogical outcomes are systematically presented in Figure 4.33, which visually synthesizes educators' perspectives on CDA's role in maintaining active learner involvement. The schematic representation captures the framework's multidimensional impact on classroom engagement dynamics.

The study contributes substantially to contemporary educational discourse by empirically validating CDA's capacity to operationalise the principles of active learning. These findings suggest that the framework's diagnostic-interactive design creates optimal conditions for developing both subject-specific mastery and transferable learning competencies. The implications extend beyond assessment methodology to inform broader conversations about learner-centered pedagogy, particularly regarding the cultivation of intellectual autonomy in diverse educational contexts.

This analysis positions CDA as an innovative pedagogical instrument that reconfigures traditional learner-teacher dynamics. By embedding diagnostic assessment within an interactive learning framework, the approach represents a significant advancement in realizing truly participatory education - one that simultaneously enhances academic outcomes while fostering the cognitive and affective dimensions of learner development. The evidence underscores the potential of

assessment-integrated teaching methodologies to nurture engaged, self-directed learners equipped for the complexities of contemporary knowledge environments.

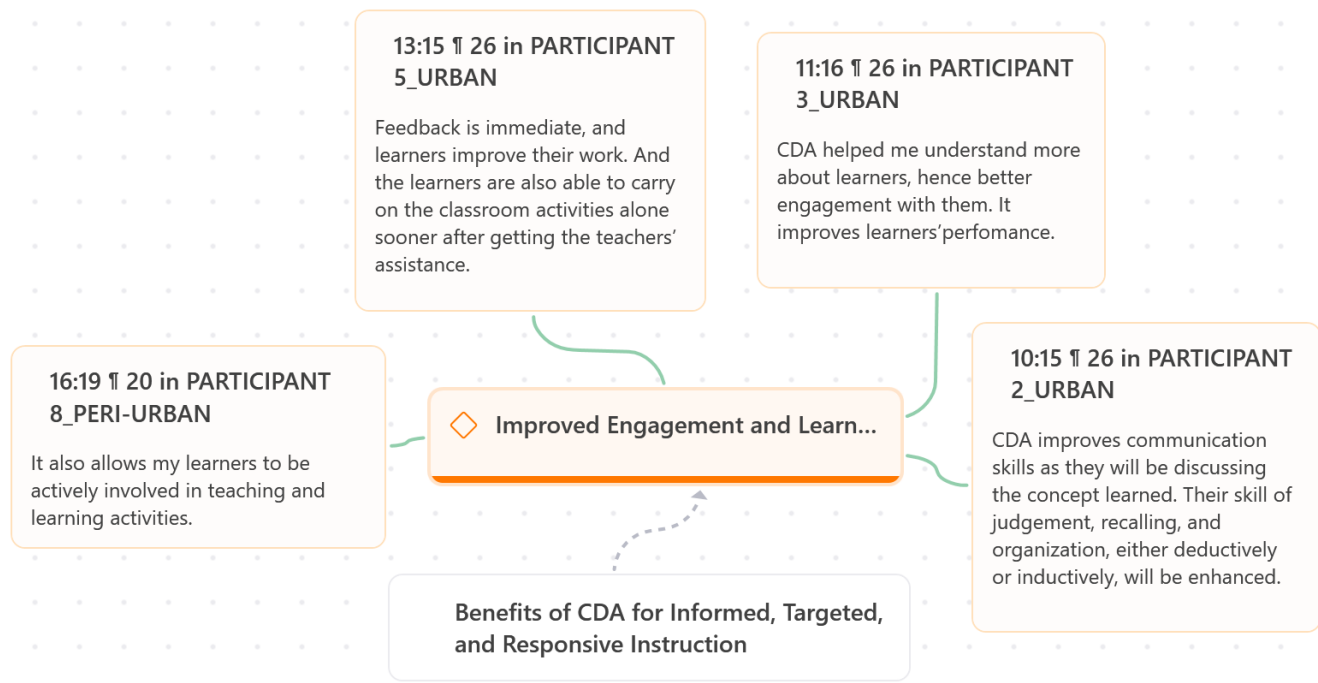


Figure 4.33 Improved engagement and learner environment

Informed Lesson Planning and Instructional Alignment

This theme illuminates how Cognitive Diagnostic Assessment (CDA) serves as a sophisticated diagnostic framework that fundamentally transforms teachers' approach to instructional design. The findings demonstrate that CDA provides educators with empirically grounded insights which facilitate a paradigm shift from content-driven to needs-based lesson planning, thereby enhancing both the precision and efficacy of classroom teaching.

Participants consistently reported that CDA enables a more intentional approach to curriculum delivery, moving beyond syllabus coverage to targeted concept mastery. As one teacher articulated, *"I now plan my lessons with purpose. That is to address the learning gaps identified, not just to cover all the concepts as indicated in the syllabus"* (P1PU). This transition from comprehensive to compensatory planning is made possible by CDA's capacity to reveal the specific architecture of learner understanding, allowing educators to structure lessons that directly address identified difficulties. Indeed, another participant emphasised how *"Knowing where they are encountering problems helps to structure my lessons to address those needs/problems"* (P3U).

The framework's diagnostic precision proves particularly valuable in facilitating timely pedagogical interventions. Teachers highlighted CDA's role in identifying precise areas requiring remediation, with one noting *"Once strengths and weaknesses have been identified, I can now plan my lessons to address those weaknesses. And I can easily see where I have to offer remedials"* (P6PU). This capacity for targeted support ensures inclusive pedagogical practices, as captured in the reflection that *"It helped me to know where and how to start in different concepts, so that some learners cannot be left behind"* (P7PU).

Moreover, CDA's formative feedback loop enables educators to anticipate and respond to learning obstacles proactively. A participant explained how *"It also helps me to plan my lessons accordingly because I will know my learners' weaknesses, and that helps me to easily intervene"* (P7PU). This anticipatory planning is further enhanced by the framework's capacity to provide clear pedagogical direction, with another teacher observing that *"Use of CDA helps me as the teacher to have a clear direction of where to start when teaching"* (P8PU).

These transformative effects on instructional design are systematically presented in Figure 4.34, which visually synthesises teachers' perspectives on CDA's role in facilitating informed lesson planning and curricular alignment. The schematic representation captures the framework's capacity to translate diagnostic insights into strategic pedagogical action.

The study makes a substantive contribution to educational research by empirically validating CDA's potential to bridge the persistent divide between assessment data and instructional practice. These findings suggest that the framework's diagnostic-prescriptive cycle creates optimal conditions for realising differentiated pedagogy in diverse classroom contexts. The implications extend beyond immediate teaching applications to inform broader conversations about curriculum design, highlighting the importance of flexible, data-responsive planning in contemporary education.

This analysis positions CDA as both an evaluative instrument and pedagogical compass, guiding educators in developing precisely calibrated teaching strategies. By transforming assessment intelligence into actionable instructional plans, the framework represents a significant advancement in evidence-based teaching practice - one that prioritises learner needs while maintaining rigorous academic standards. The evidence underscores the potential of diagnostic assessment methodologies to revolutionise conventional approaches to lesson planning, fostering

teaching that is simultaneously more responsive to individual differences and more effective in promoting comprehensive learning outcomes.

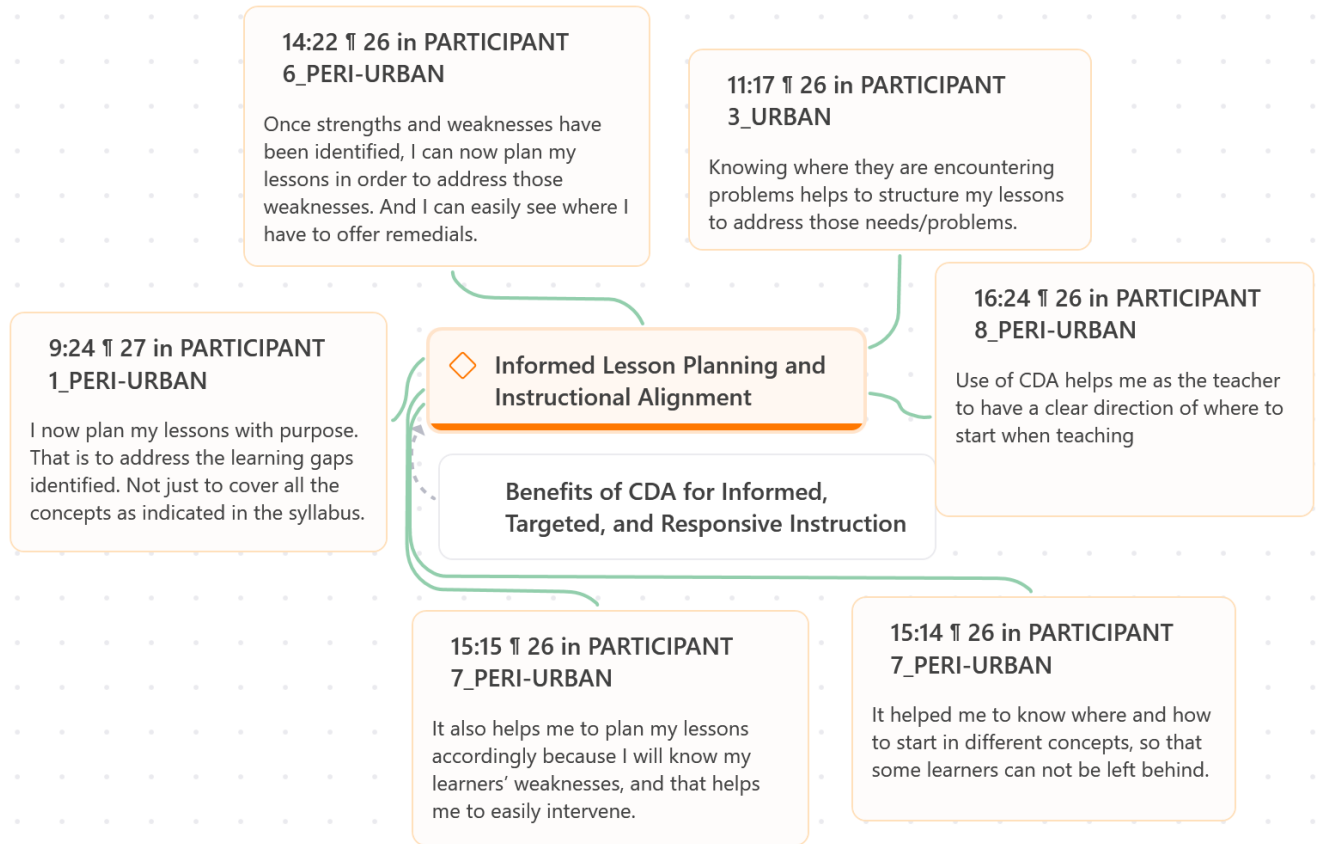


Figure 4. 34: Informed lesson planning and instructional alignment

OBSERVED ANY CHALLENGES OR LIMITATIONS IN USING CDA TO SUPPORT STUDENT LEARNING OUTCOMES

A thematic analysis of the data elucidates a constellation of challenges and limitations impeding the efficacious deployment of Cognitive Diagnostic Assessment (CDA) by teachers. A salient finding pertains to the diagnostic impediments presented by introverted learners, whose reticence to engage overtly complicates the accurate delineation of their cognitive attributes and deficits as presented: *Some students are introverts, so it is not easy for them to open up; hence, it is difficult to diagnose their strengths and weaknesses (P2U)*. This diagnostic opacity is further exacerbated

by the resource-intensive, personalised support these students necessitate “*For that matter, assisting them on the go is a huge challenge*” (P2U).

A predominant and frequently cited constraint is that of temporal exigency. The implementation of CDA was consistently characterised as a profoundly time-intensive endeavour, a factor acutely magnified within the context of substantial class cohorts, thereby rendering individualised diagnosis pedagogically demanding: “*Although CDA is very useful, it is time-consuming, especially when dealing with a large group*” (P3U); “*It creates a lot of tiring work, it consumes a lot of time*” (P5U).

Further implementation barriers identified include discernible student resistance to alternative assessment modalities, particularly amongst those habituated to conventional examination formats “*Some students resist non-traditional tasks, especially if they are used to exams*” (P4U)), and a critical deficit in teacher preparedness stemming from insufficient professional development: “*A lack of formal training in CDA makes it difficult to implement CDA effectively*” (P4U)).

Finally, structural and infrastructural impediments were highlighted, specifically the prerequisite for specialised digital resources that are often unattainable in financially constrained environments (“*CDA also needs some resources like specific software... especially local schools cannot afford it*” (P6PU)). In sum, these findings underscore the multifarious nature of the barriers encompassing contextual, technical, and capacity-related dimensions that must be substantively addressed to facilitate the robust integration of CDA across diverse educational milieus.

The prevalence and interplay of these challenges, as perceived by practitioner respondents, are graphically delineated in Figure 4.35, serving to illustrate that notwithstanding its purported benefits, the effective application of CDA is contingent upon the mitigation of significant practical obstacles.

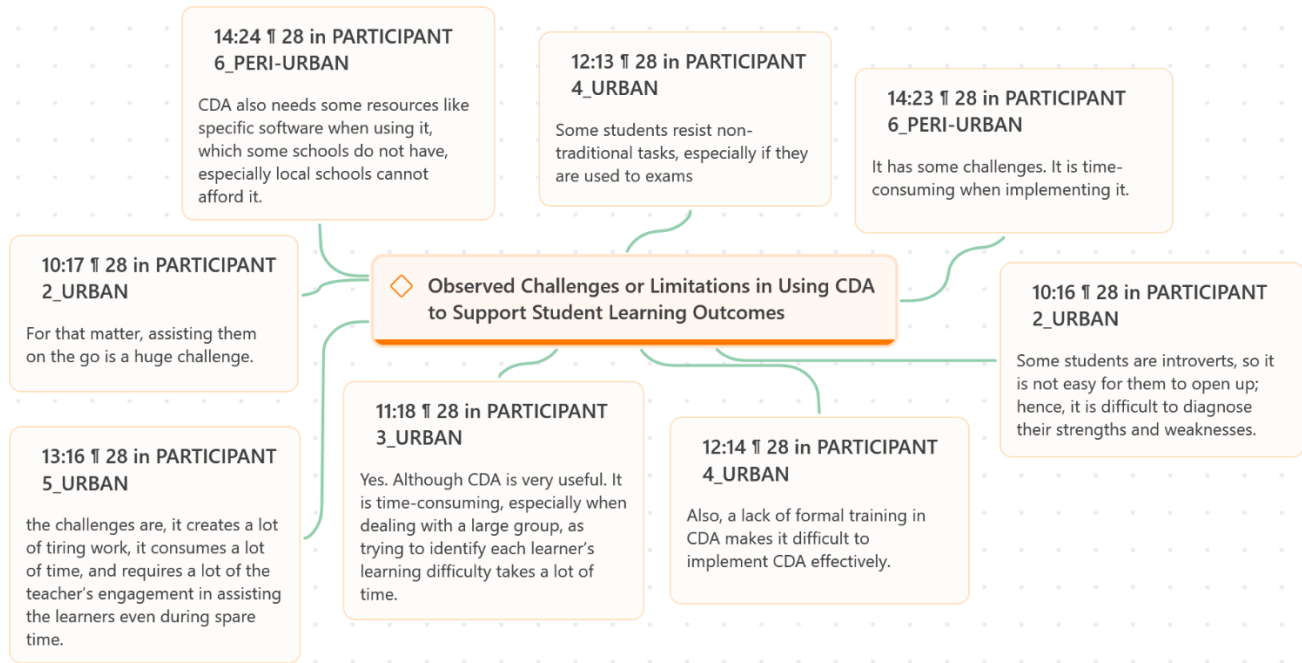


Figure 4.35: Observed challenges or limitations in using CDA to support student learning outcomes

QUESTION 3a). What are the main challenges faced by practicing teachers when integrating CDA into their classrooms?

PRIMARY CHALLENGES IN INTEGRATING CDA INTO CLASSROOM PRACTICE

Thematic analysis of the data explains the principal impediments confronting teachers in the implementation of Cognitive Diagnostic Assessment (CDA) within authentic classroom environments. While the pedagogical utility of CDA in fostering individualised learning and pinpointing specific cognitive deficits and proficiencies is recognised by practitioners, its adoption is significantly obstructed by a suite of pragmatic constraints. These challenges coalesce into three interrelated sub-themes: firstly, Overcrowded Classrooms and High Learner Diversity, which encapsulates the inherent difficulty of delivering tailored diagnostic interventions within large, heterogenous student cohorts; secondly, Time and Workload Demands, which reflect the resource-intensive nature of designing, administering, and interpreting CDA tasks; and thirdly, Insufficient Training and Support, which denotes a critical deficit in professional development and institutional backing necessary for the effective integration of CDA methodologies. Collaboratively, these sub-themes underscore the profound structural and systemic barriers that necessitate resolution for

CDA to transition from a theoretical model to a sustainable and efficacious component of instructional practice.

The prevalence and primacy of these identified challenges are quantitatively illustrated in Figure 4.36. The data presented therein corroborates the thematic findings, highlighting the salience of insufficient training, resource limitations, excessive time and workload demands, and the pressures of overcrowded classrooms as the foremost obstacles to implementation.

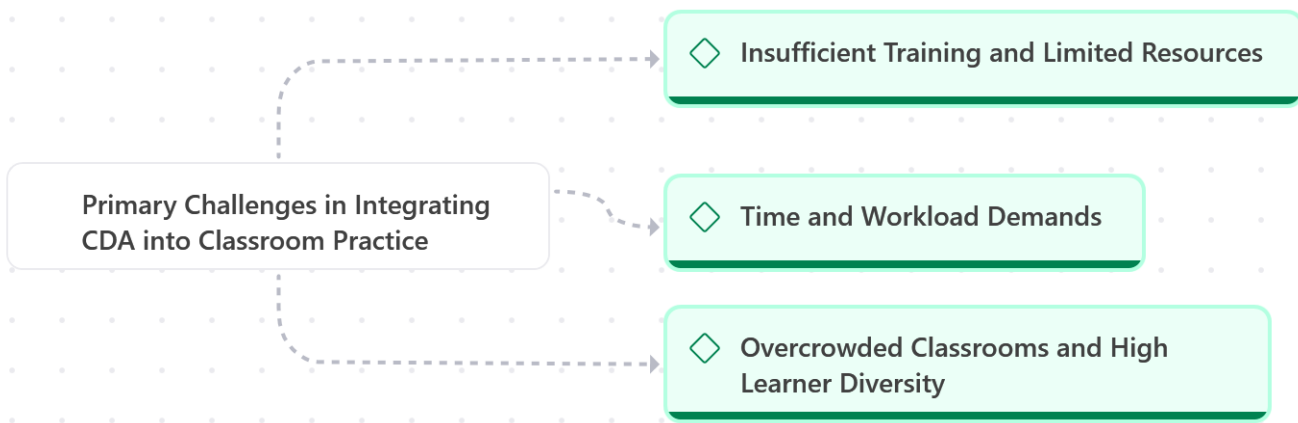


Figure 4.36: Primary challenges in integrating CDA into classroom practice

Insufficient Training and Limited Resources

A predominant constraint identified by a significant number of participants pertains to the inadequacy of preparatory training. Teachers articulated a pronounced need for more comprehensive, sustained professional development initiatives to attain the requisite proficiency and confidence in deploying CDA methodologies. This sentiment is illuminated in the assertion that, *"Another challenge was with the limited training that we received on the use of CDA"* (P1PU).

Concomitantly, a critical deficiency in appropriate tools and infrastructural support was highlighted as a substantial barrier. The effective administration of CDA is often contingent upon specialised resources such as dedicated software and assessment materials which are frequently unavailable in institutions operating under resource constraints. Participant testimony underscores this issue: *"Lack of resources that teachers can use to help them undertake CDA assessments, but their schools do not have"* (P2U) and *"CDA also needs some resources like specific software when using it, which some schools do not have, especially local schools cannot afford it"* (P6PU).

Further exacerbating these challenges is the temporally intensive nature of the assessment process. Teachers reported that the endeavour to diagnose and remediate individual learning difficulties is profoundly time-consuming, demanding a significant allocation of pedagogical attention that is often unsustainable: *"It was also time-consuming, as addressing individual problems requires a lot of time"* (P7PU).

From a learner-centric perspective, affective factors, including pronounced shyness and a propensity for demotivation following incorrect responses, were identified as material barriers to engagement. These emotional responses can inhibit active participation in diagnostic tasks and subsequent remedial interventions, thereby compromising the formative potential of CDA: *"Some learners are shy, and they become demotivated by wrong responses, even when they are supposed to come for remedials"* (P2U).

In concert, these findings indicate that whilst CDA presents considerable promise for personalised instruction, its successful integration is heavily contingent upon resolving systemic issues. These include robust teacher preparation, substantive institutional investment in resources, and the development of pedagogical strategies sensitive to learner affect and engagement.

The prevalence and perceived impact of the constraints related to insufficient training and limited resources are further quantified and illustrated in Figure 4.37, which synthesises teachers' perspectives on these salient barriers.

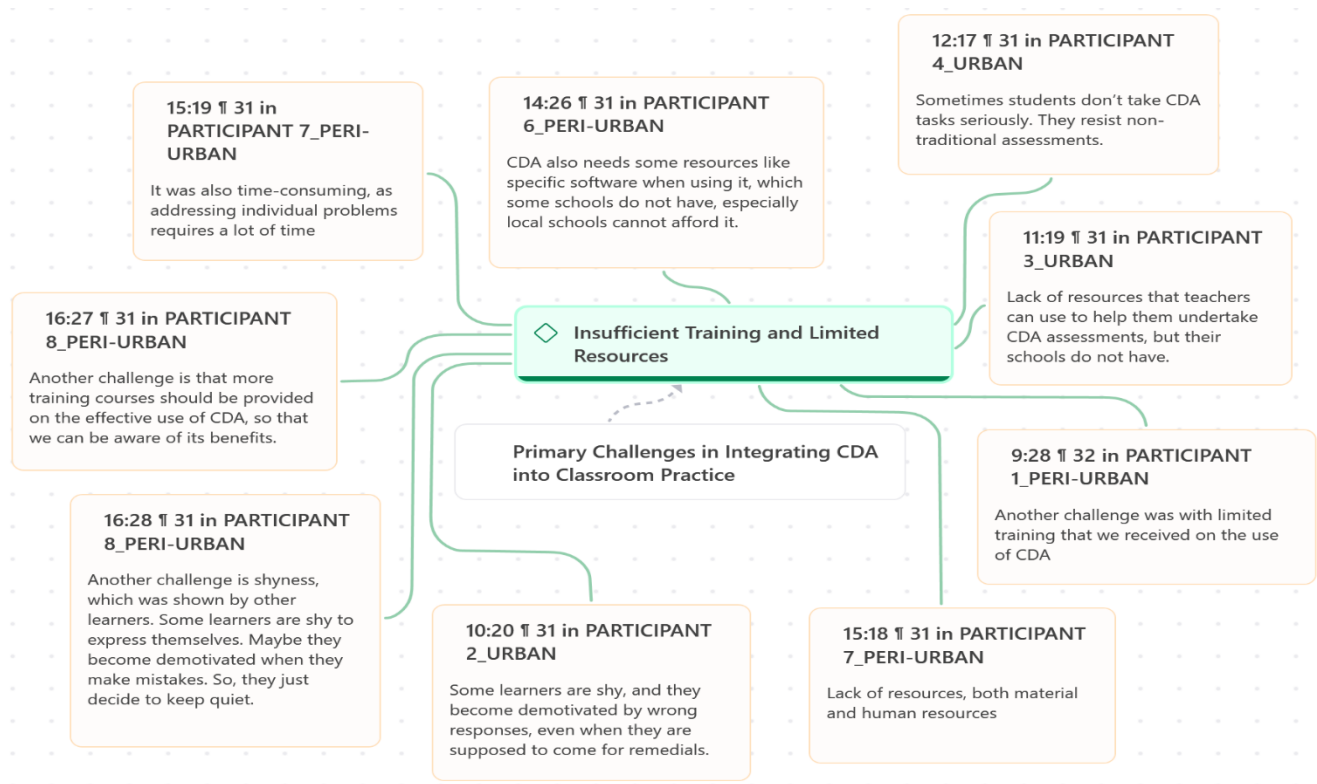


Figure 4. 37: Insufficient training and limited resources

Overcrowded Classrooms and High Learner Diversity

This theme elucidates the profound structural and logistical impediments that obstruct the effective assimilation of Cognitive Diagnostic Assessment (CDA) into standard pedagogical practice. Practitioners uniformly identified excessive class sizes as a primary barrier, rendering the individualised attention fundamental to CDA's methodology virtually unmanageable. This constraint is captured in participant testimonies, such as, "*Congested classroom. This makes it difficult to attend to all learners*" (P1PU), and further explicated by the observation that a "*Teacher-pupil ratio is high, so it's not easy to attend to every child with one or two lessons*" (P2U). Such conditions critically undermine the operational feasibility of conducting nuanced, in-depth diagnostic procedures.

Compounding this issue is the pressure exerted by an already saturated national curriculum, which severely curtails the temporal scope available for diagnostic activities. As one participant succinctly stated, "*Again, the curriculum is packed, leaving little room for diagnostic activities*" (P4U). Furthermore, the inherently labour-intensive character of CDA was emphasised, with one teacher characterising it as "*Time-consuming... It creates a lot of tiring work, it consumes a lot of*

time, and requires a lot of the teacher's engagement in assisting the learners, even during their spare time" (P5U). This points to a significant and often unsustainable augmentation of the teacher's workload.

Together, these findings present a fundamental dissonance between the theoretical promise of CDA and the material realities of under-resourced, high-pressure educational settings. The analysis suggests that resolving this impasse necessitates policy-level interventions aimed explicitly at ameliorating adverse teacher-learner ratios and introducing greater flexibility into curricular design.

The pervasive nature of these concerns regarding classroom congestion and its deleterious impact on CDA efficacy is quantitatively corroborated in Figure 4.38. The data presented therein synthesises practitioner perspectives, demonstrating conclusively how overcrowded conditions and pronounced learner diversity act as material inhibitors to the successful performance of diagnostic assessment protocols.



Figure 4. 38: Overcrowded classroom and high learner diversity

Time and Workload Demands

A prominent theme emerging from the data indicates that a principal barrier to the effective integration of Cognitive Diagnostic Assessment (CDA) into classroom practice is the substantial

demand it places on teachers' time and effort. Across a series of interviews, educators consistently characterised CDA as a profoundly labour-intensive process that disrupts standard instructional rhythms and significantly augments their existing administrative burdens.

This perception is substantiated by direct participant testimony. One educator stated, *"Use of CDA requires a lot of time, as I must design an assessment task, administer it to learners, mark and interpret the results"* (P1PU). This view was frequently reiterated, with others highlighting how contextual factors such as heterogeneous learner abilities and high pupil-to-teacher ratios exacerbate the time commitment: *"Administering CDA takes up a lot of time, and teachers may be stressed because of overcrowded classrooms"* (P3U); *"It is also time-consuming, due to their cognitive levels that differ"* (P2U).

A consequential impact of this additional demand is the disruption to curriculum pacing. As one participant explained, *"While integrating CDA in my teaching, I take a longer time to finish my planned lesson, thus making me behind the scheme. This is because I must focus on individual problems of each learner"* (P5U). Beyond the act of administration, the need for specialised skills was also identified as a contributing factor to the workload, particularly concerning the interpretation of data: *"It also requires enough training, especially on how to record and interpret learners' feedback"* (P7PU).

In unison, these insights demonstrate that while the pedagogical value of CDA is recognised, its practical application is severely constrained by the excessive temporal investment and workload pressures it imposes on teachers. This draws attention to a critical requirement for enhanced institutional support, the development of more streamlined assessment processes, and targeted professional development to mitigate these impediments.

These teachers' views on how time and workload demand hinder CDA implementation are summarised in Figure 4.39.

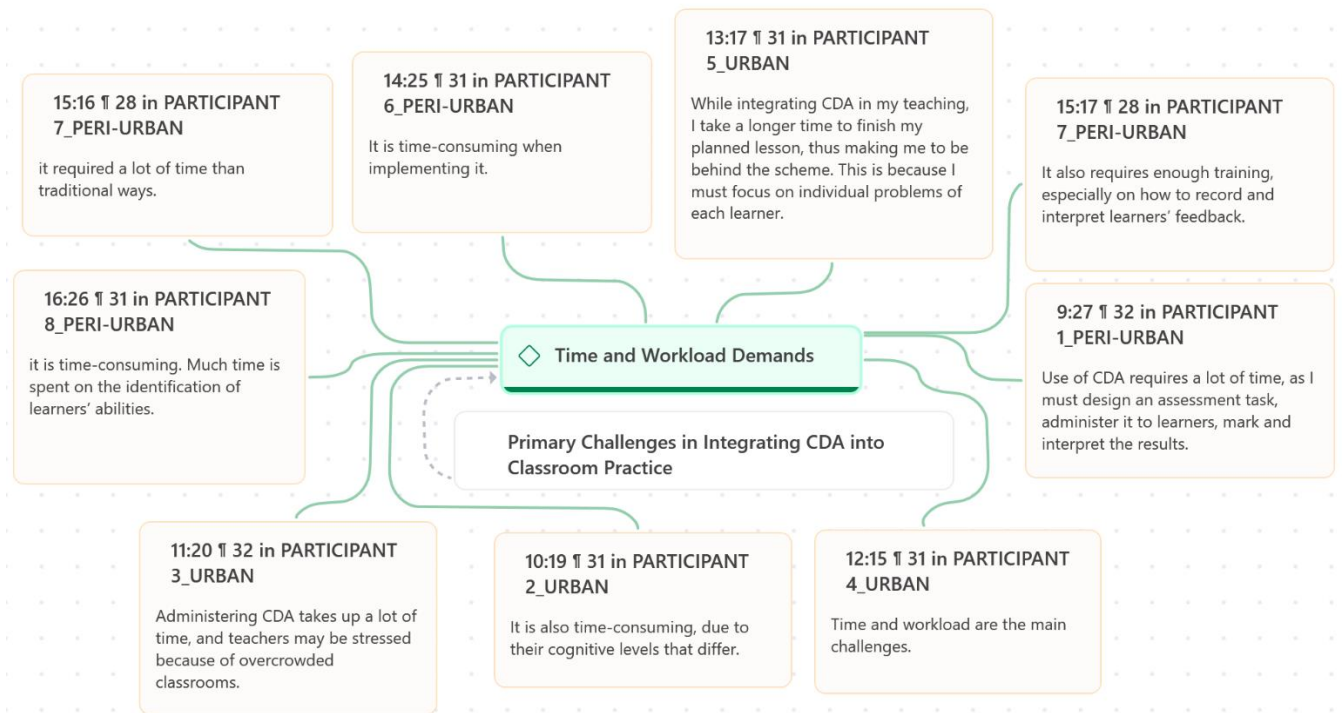


Figure 4.39: Time and workload demand

TEACHERS' ADAPTIVE STRATEGIES FOR NAVIGATING RESOURCE AND LOGISTICAL CONSTRAINTS IN IMPLEMENTING CDA

The integration of innovative pedagogical frameworks often encounters a stark reality at the classroom level, where theoretical promise meets practical constraint. This is acutely evident in the implementation of Cognitive Diagnostic Assessment (CDA), a methodology designed to provide fine-grained insights into student cognition. While previous analyses have rightly identified significant exogenous barriers such as excessive time demands, and workload pressures a more nuanced theme emerges from the data: the profound agency and adaptability of teachers. This essay argues that, despite operating within environments characterised by limited access to training, digital tools, and specialised materials, teachers devise and deploy a range of pragmatic, self-generated strategies to sustain the use of CDA. Their actions, driven by a commitment to improving student outcomes, reveal a pattern of professional ingenuity that manifests through low-tech substitution, flexible reappropriation of existing resources, and self-directed learning.

The first and most immediate adaptive strategy involves the improvisation of low-technology modalities to replicate the diagnostic function of specialised tools. In the absence of bespoke

software or assessment platforms, teachers demonstrate remarkable resourcefulness by leveraging fundamental pedagogical instruments. As the data indicates, sustained and structured observation becomes a primary diagnostic tool, allowing teachers to infer cognitive processes in real-time. Similarly, customised printed worksheets and deliberate verbal questioning sequences are repurposed from their conventional instructional roles to serve as mechanisms for uncovering individual learning gaps and cognitive attributes. This sub-theme underlines a critical principle: that the core value of CDA lies not in its technological sophistication, but in its analytical approach, which can be approximated, albeit with greater effort, through analogue means.

A second, strategic adaptation is found in the iterative adjustment of pedagogical planning and the contextual reappropriation of available assets. Teachers reported engaging in what can be termed 'flexible scaffolding' adjusting teaching schedules, pacing, and lesson structures to create windows for diagnostic interactions. Furthermore, a process of pedagogical bricolage is evident, wherein standard exercises and existing tasks are analytically deconstructed and reframed to serve dual purposes: delivering curriculum content while simultaneously generating diagnostic data on student understanding. Beyond manipulating their own resources, teachers also mobilise external support networks, seeking assistance from colleagues for collaborative problem-solving and, in some cases, enlisting parents to facilitate aspects of the assessment process. This demonstrates a holistic view of the classroom ecosystem, where every element is a potential resource to be leveraged in overcoming implementation barriers.

The third adaptive sub-theme moves beyond immediate classroom logistics to address the foundational need for expertise. Confronted with a deficit in formal professional development, teachers exhibit agentic professional development, proactively seeking to build their own capacity for implementing CDA. This autodidactic approach primarily involves self-directed learning through independent reading and intensive online research. By curating their own knowledge from digital sources, practitioners autonomously fill the training void, developing the necessary conceptual understanding to interpret learner feedback and refine their assessment techniques. This highlights a significant intrinsic motivation and a resilient commitment to pedagogical improvement, even in the absence of institutional support systems.

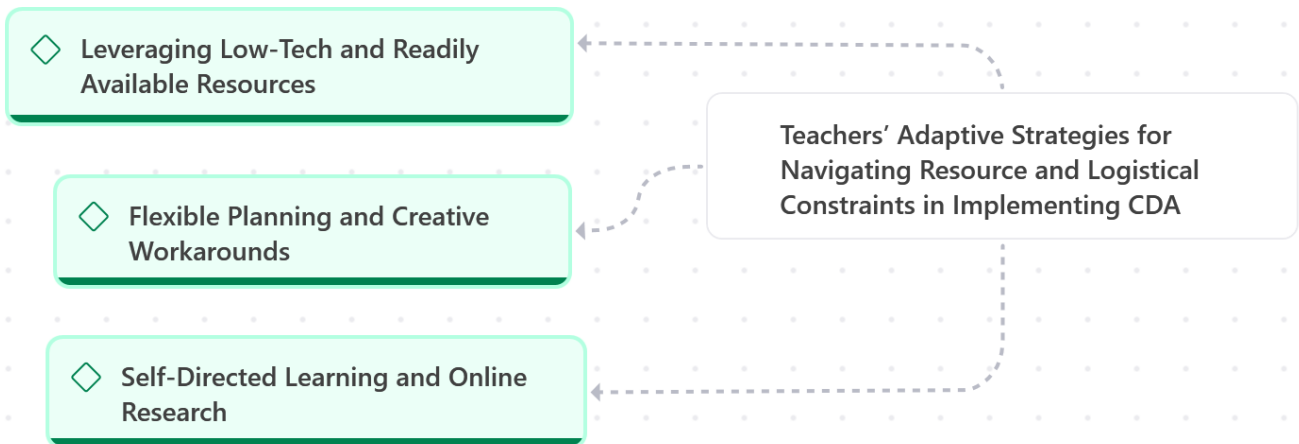


Figure 4.40: Teachers' adaptive strategies for navigating resources and logistical constraints in implementing CDA

Flexible Planning and Creative Workarounds

This sub-theme elucidates the strategic and adaptive methodologies employed by teachers to mitigate resource and logistical impediments to the implementation of Cognitive Diagnostic Assessment (CDA). The data reveals a pattern of pragmatic innovation, where teachers prioritise the efficient repurposing of existing assets over the creation of novel materials. This approach is encapsulated by one participant's reflection: *"I also think, instead of designing a new assessment task, I can use the task already available, though they were not meant for diagnostic purposes, just add skills that I want to assess"* (P1PU). This signifies a conscious pedagogical recalibration of available resources to serve diagnostic ends.

Further strategies to circumvent constraints include mobilising community support and personally absorbing additional labour. As one teacher noted, this involves a pragmatic appeal to parents for material support: *"Where additional materials are needed, I ask the parents to assist with funding, but most of the time, I use what I have"* (P5U). Others commit to extending their working hours to create the necessary time for diagnostic practices, a commitment summarised by the succinct statement, *"I will also do extra classes"* (P6PU).

Beyond individual adaptation, the cultivation of collaborative professional networks emerges as a critical support mechanism. Participants reported that sharing knowledge and strategies with colleagues provides vital insights for implementation within a low-resource context:

“Collaborating with other teachers also helps a lot. As we get to share how others implement it, when the resources are limited” (P6PU).

To optimise the use of time a consistently identified barrier teachers implemented deliberate procedural interventions. These ranged from the use of strict timekeeping tools to enforce pacing “I will also have the stopwatch, so that I can only spend a certain time on a certain skill” (P7PU) to the structural integration of diagnostic moments into standard lesson planning: “Include 10 minutes for diagnostic purposes in each class, after teaching, this will give me some time to help unable learners” (P8PU).

As a whole, these reflections demonstrate a profound capacity for resourcefulness and flexibility, illustrating how teachers develop context-specific solutions to ensure the meaningful integration of CDA into their pedagogical routines despite systemic limitations. The various adaptive strategies cited by teachers, which serve to alleviate associated workload pressures, are systematically categorised in Figure 4.41.

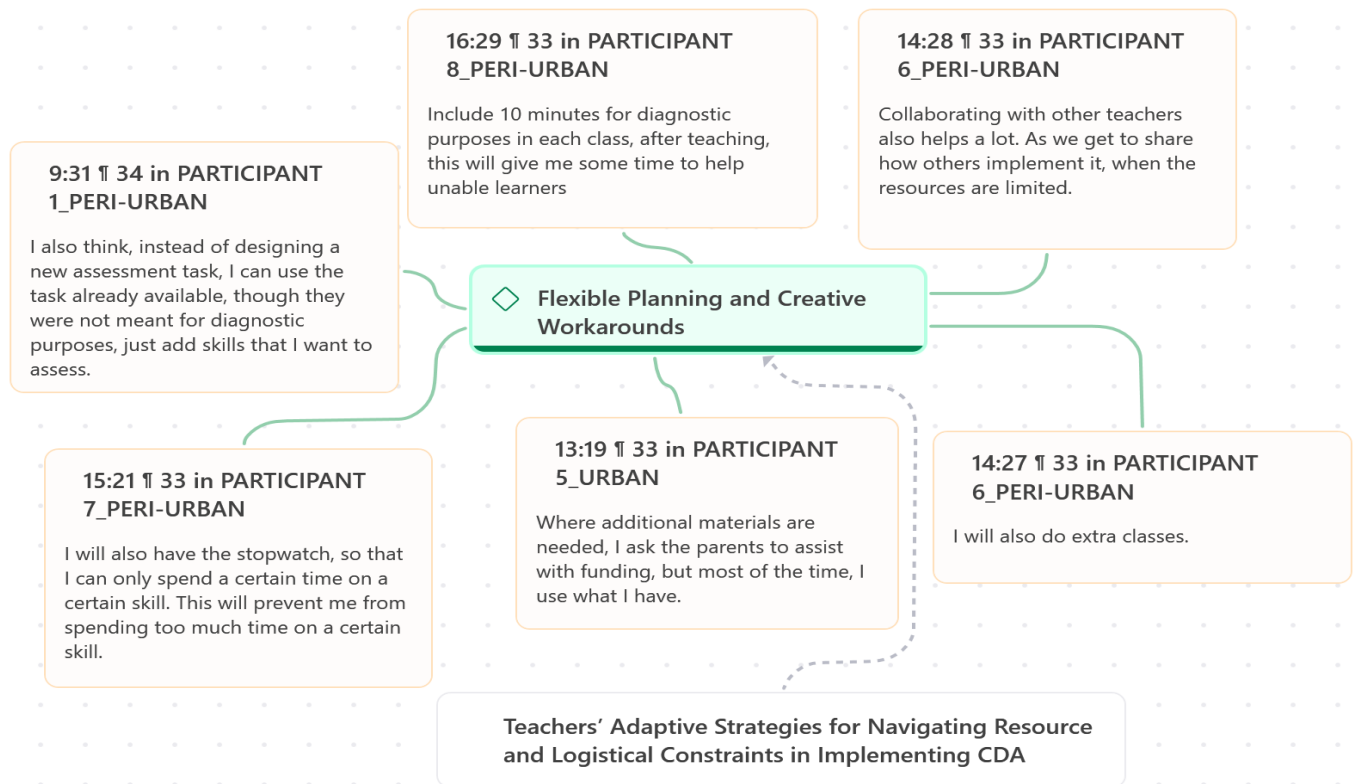


Figure 4. 41: Flexible planning and creative workarounds

Leveraging Low-Tech and Readily Available Resources

This sub-theme delineates the adaptive pedagogical strategies teachers employ to circumvent the absence of sophisticated diagnostic technologies for implementing Cognitive Diagnostic Assessment (CDA). Faced with infrastructural constraints that preclude the use of specialised software or digital platforms, practitioners demonstrate a capacity for tactical substitution, utilising accessible, low-technology methods to glean insights into learner cognition. This approach is characterised by a reliance on fundamental teacher-led techniques and readily available physical materials.

The data indicates that direct, structured observation is a primary diagnostic tool in these contexts. As one participant articulated, *“Since there are no software (special tools) to help me get deeper insights into my learners’ strengths and weaknesses, I will continue to use observation. That is, after giving learners a task, I will observe their responses and interpret them”* (P1PU). This method is often supplemented with other low-resource materials, as another teacher noted: *“Download some cognitive assessment tests from the internet. I will also use observation since they are no software to help get to get exact information about learners’ strengths and weaknesses”* (P3U).

Beyond observation, the strategic deployment of basic instructional resources forms a core component of this adaptive practice. Participants reported utilising *“printed worksheets and verbal questioning”* (P4U) or adopting a general philosophy of making do, summarised by the statement, *“For lack of resources, I use whatever material is available”* (P7PU). A further significant adaptation involves the conscious rationing of CDA application to ensure its sustainability. One educator explained this pragmatic decision-making: *“Again, since there is a lack of resources (tools to use when implementing CDA), I found it important to use what I have. I have also decided not to use it every day”* (P8PU).

In total, these accounts reveal a consistently resourceful and pragmatic mindset among educators. Their strategies enable them to maintain the diagnostic intent of CDA, upholding its focus on identifying individual cognitive strengths and weaknesses, despite operating within significant material and infrastructural limitations. The specific types of low-tech and readily available resources utilised by teachers in these constrained environments are catalogued systematically in Figure 4.42.

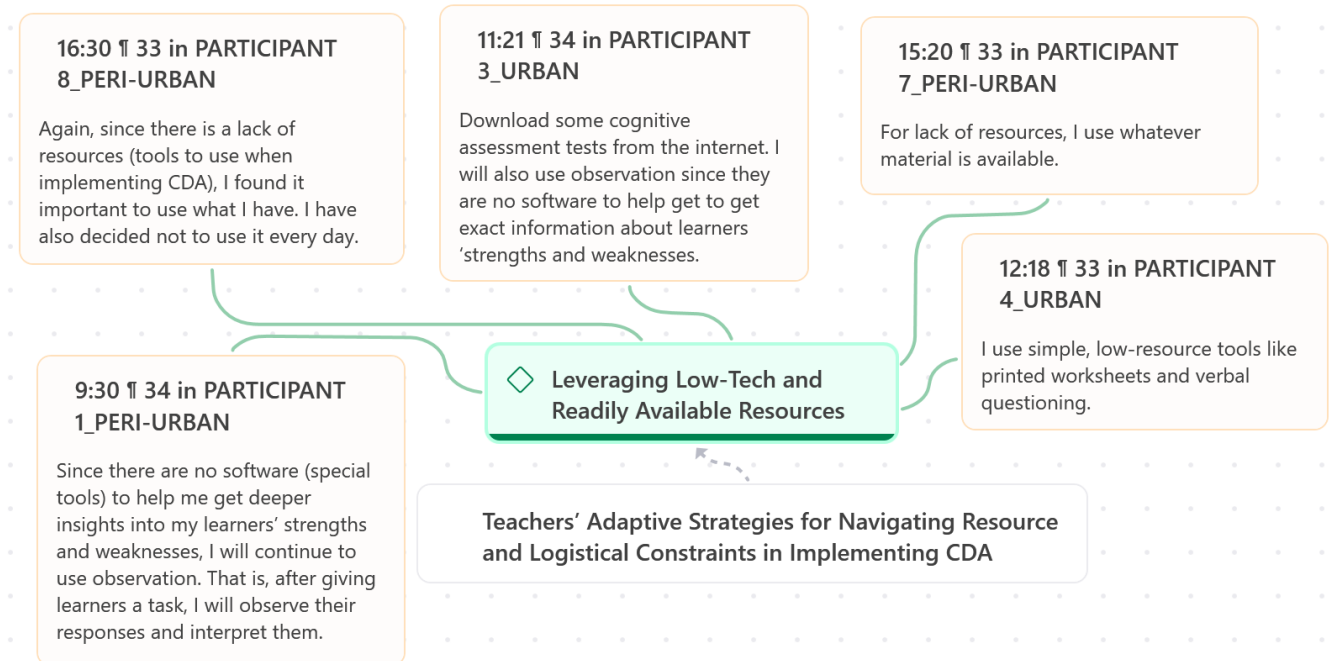


Figure 4.42: Leveraging low-tech and readily available resources

Self-Directed Learning and Online Research

This sub-theme spells out the agentive role of educators in autonomously cultivating their expertise in Cognitive Diagnostic Assessment (CDA) amidst a notable deficit in formal professional development and institutional scaffolding. Confronted with this training gap, practitioners engage in a process of self-directed scholarship, proactively utilising digital and academic resources as categorised in Figure 4.43 to construct their own operational knowledge base. This represents a critical, self-initiated compensatory strategy for building pedagogical capacity.

The data reveals a consistent pattern of practitioners turning to the internet to engage with a broader community of practice, seeking out applied models to inform their own implementation. This is evidenced by one participant's statement: *“I use the internet to research more on how other teachers implement it effectively”* (P1PU). This approach transcends mere information retrieval, constituting a form of vicarious learning from the documented experiences of peers.

Furthermore, this self-development is characterised by a targeted engagement with scholarly literature to acquire the necessary conceptual and procedural knowledge. As another participant emphasised, this reading is explicitly linked to enhancing practical application: *“I read some*

articles that talk about CDA, so that I can get more information on CDA. This is for my personal development on how to implement CDA” (P2U). This autodidactic endeavour is positioned as an essential response to the inherent complexities of CDA, which demand a level of pedagogical clarity that absent training fails to provide. A third participant directly correlates this need for understanding with their independent research activities: “Since the use of CDA requires a lot of training, I will read about how other people use it using the internet” (P3U).

Jointly, these reflections underscore a paradigm of professional development that is intrinsically motivated and externally resourced. They highlight how teachers, driven by a commitment to pedagogical efficacy, leverage publicly available online and academic resources to compensate for systemic support deficiencies, thereby independently forging the expertise required for the complex task of CDA implementation.

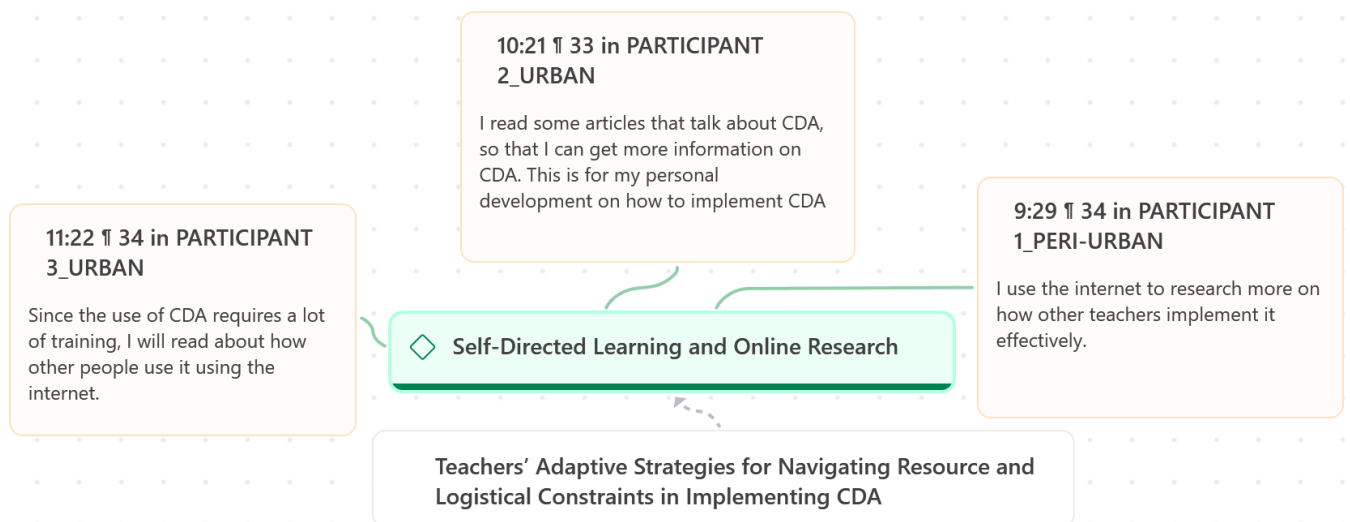


Figure 4. 43: Self-directed learning and online research

RESISTANCE OR SKEPTICISM FROM COLLEAGUES OR ADMINISTRATORS REGARDING THE USE OF CDA

This theme examines participants' accounts of institutional or collegial resistance encountered during their efforts to implement Cognitive Diagnostic Assessment (CDA). A significant finding, as quantified in Figure 4.44, is that a majority of teachers reported an absence of material opposition from either peer educators or school administration. This sentiment is captured in direct participant assertions such as, "No, I did not encounter any resistance from my colleagues or

administrators" (P1PU). In several instances, the institutional posture was not merely permissive but actively supportive, a factor often linked to prior exposure and training: *"No, they highly recommend it. Especially my principal, because he was there during the training that was provided on the use of CDA"* (P7PU). Furthermore, existing collaborative professional structures were identified as a facilitative factor, with one teacher noting, *"Never encountered resistance from my colleagues, instead, we work as a team because we do subject teaching"* (P3U).

Notwithstanding this generally favourable reception, the data does document isolated instances of skepticism. These were rooted in perceptions of CDA as an ancillary burden that diverges from established assessment conventions. One respondent articulated this view, noting that *"some colleagues see it as 'extra work' and prefer to stick to tests," adding that "administrators may not prioritize CDA since it is not part of the formal reporting structure"* (P4U). Consequently, while overt resistance is not a predominant barrier, these findings indicate that the absence of formal integration into accountability systems and a perception of increased workload can engender reluctance amongst a minority of stakeholders, potentially hindering broader, consistent implementation.

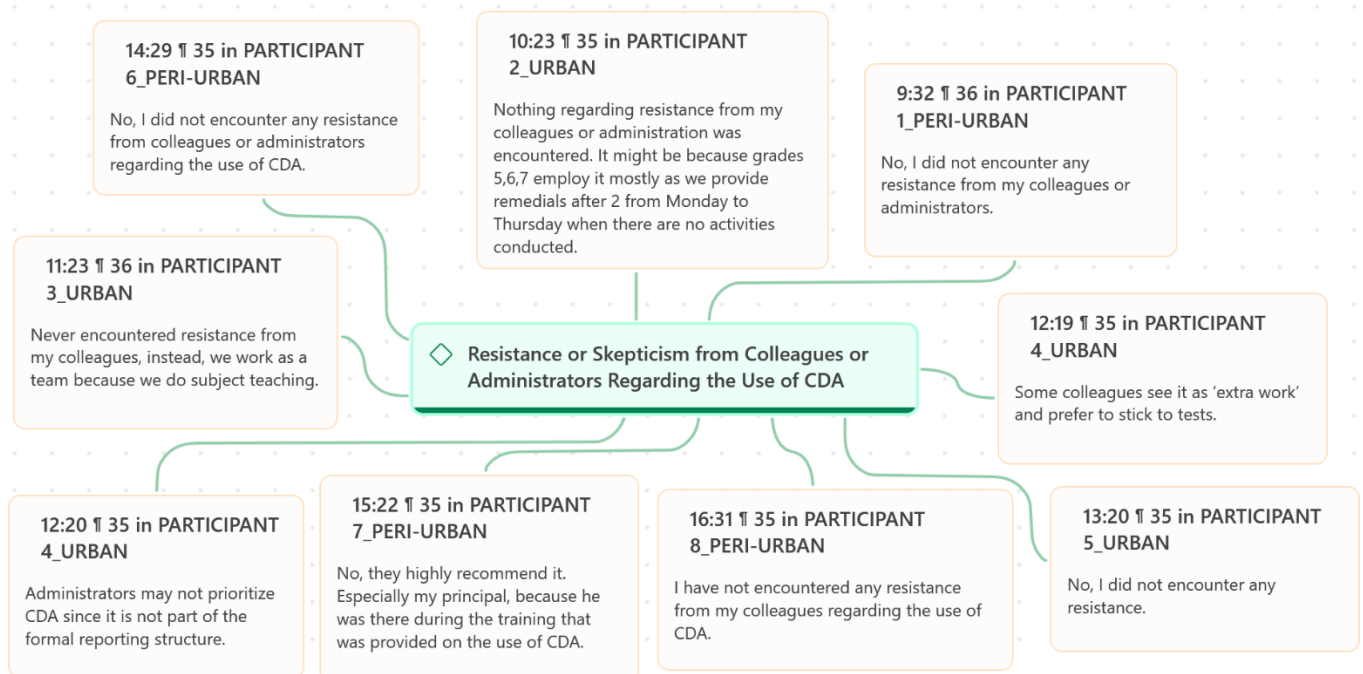


Figure 4. 44: Resistance or scepticism from colleagues or administrators regarding the use of CDA

QUESTION (3b). What strategies do they employ to address these challenges?
ADAPTIVE STRATEGIES FOR OVERCOMING CHALLENGES IN IMPLEMENTING CDA

The theme encompasses the (see figure 4.45) inventive and context-specific approaches teachers employ to navigate the practical difficulties of integrating Cognitive Diagnostic Assessment into their classrooms. Despite facing constraints such as limited time, large class sizes, and scarce resources, teachers demonstrate resilience and adaptability through three key strategies. First, they rely on collaborative support and resource optimization, leveraging peer collaboration, parental involvement, and available materials to sustain CDA practices. Second, they commit to remedial and extra instructional time, offering individualized and extended learning sessions beyond regular school hours to address learners' specific needs. Third, they employ strategic learner grouping for efficient remediation, clustering students with similar learning gaps to streamline instruction and reduce workload. These sub-themes collectively highlight teachers' proactive and learner-centered efforts to ensure the effective use of CDA, even in resource-constrained educational settings.



Figure 4.45: Adaptive strategies for overcoming challenges in implementing CDA

Collaborative Support and Resource Optimisation

This theme delineates the strategic and agentic methodologies employed by educators to facilitate the implementation of Cognitive Diagnostic Assessment (CDA) within constrained operational

contexts. As synthesised in Figure 4.46, practitioners consciously leverage interpersonal collaboration and systematically optimise existing resources to mitigate identified barriers.

A cornerstone of this adaptive approach is the cultivation of collaborative professional networks. Participants explicitly identified peer support as a critical mechanism for navigating implementation challenges, with one asserting that *“Collaborating with other teachers helps a lot”* (P4U). This collaboration frequently manifests as a practical exchange of intellectual and material capital, extending beyond mere moral support. The same participant elaborated on this symbiosis, noting, *“We share materials and ideas. I also keep CDA tasks short and focused to save time”* (P4U). This illustrates a dual strategy of communal resource pooling and a deliberate design principle of task brevity to enhance procedural efficiency.

Furthermore, teachers demonstrate a capacity to extend their resource base beyond the institutional environment by mobilising parental support. This is not a primary strategy but a supplementary one, employed selectively to address specific material shortfalls: *“I ask parents to assist where additional materials are needed, but most of the time I use available resources”* (P5U).

Beyond logistical and material adaptations, the data reveals a sophisticated understanding of the affective dimensions of learning necessary for successful diagnosis. Teachers implement strategies to foster a classroom climate conducive to the vulnerability required for revealing cognitive processes. This is evidenced by the use of positive reinforcement to maintain learner engagement irrespective of answer accuracy, as one participant described: giving *“learners motivation, like sweets, just to cheer them up... even if their responses were not correct”* (P8PU).

In totality, these practices underscore a pattern of *adaptive resilience*. Faced with systemic limitations, educators do not merely persevere but actively engineer a support ecosystem through the creative marshalling of human and material resources, both within and beyond the traditional school setting, to ensure the sustainable application of CDA.

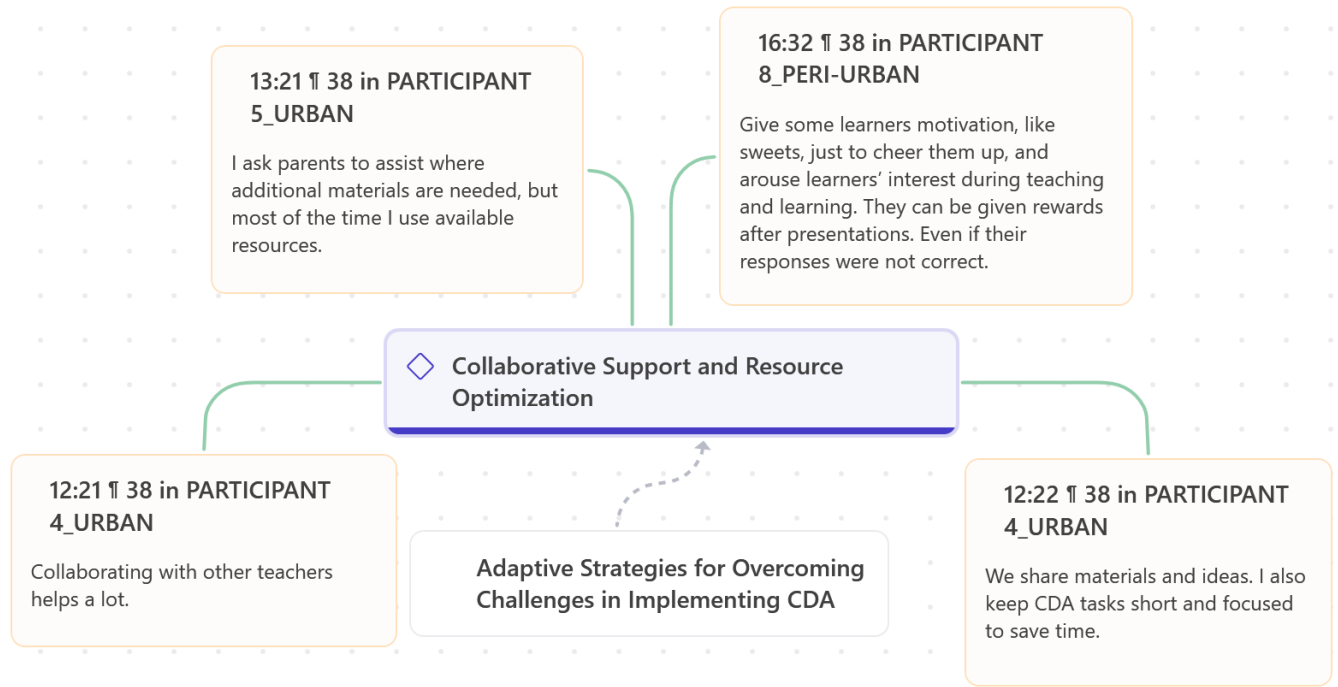


Figure 4. 46: Collaborative support and resource optimization

Remedial and Extra Instructional Time

This theme elucidates the significant investment of additional time and labour by teachers, undertaken beyond the parameters of the formal curriculum, to address learning deficits identified through Cognitive Diagnostic Assessment (CDA) (see Figure 4.47). This investment constitutes a direct operationalisation of a commitment to differentiated instruction and targeted learner support, representing a substantive extension of professional duties.

The data reveals a pattern of structured, extra-curricular intervention designed for individualised remediation. One participant detailed a highly systematic approach: *“I do remedial classes every day from 14:00 to 15:00 hours, mostly one-on-one method, where I plan individualized learning to help those who might still be behind after group work”* (P1PU). This illustrates a deliberate shift from group-level instruction to bespoke pedagogical strategies tailored to specific cognitive gaps.

Furthermore, teachers demonstrate a strategic use of unconventional timeframes to optimise learner readiness and consolidate understanding. This is evidenced by initiatives scheduled outside standard hours, as another participant noted: *“I conduct remedial classes to help those who are a bit behind. I also encourage 7 am study as it prepares learners’ readiness for classes”* (P3U). The

extent of this commitment is further emphasised by the willingness to sacrifice personal time, exemplified by the teacher who stated, “*I teach my learners even during break time*” (P5U).

The fundamental driver of these interventions is the imperative for error correction and conceptual mastery directly arising from CDA findings. This objective is succinctly captured by the participant who explained, “*I also hold extra classes in order to help those who were struggling to rectify their mistakes*” (P6PU).

In concert, these accounts demonstrate that the implementation of CDA compels educators to architect and facilitate a parallel system of remedial and extended learning opportunities. This system is characterised by its flexibility, its focus on individual needs, and its ultimate purpose: to ensure the efficacy of the diagnostic process by directly addressing its findings, thereby preventing any learner from being overlooked.

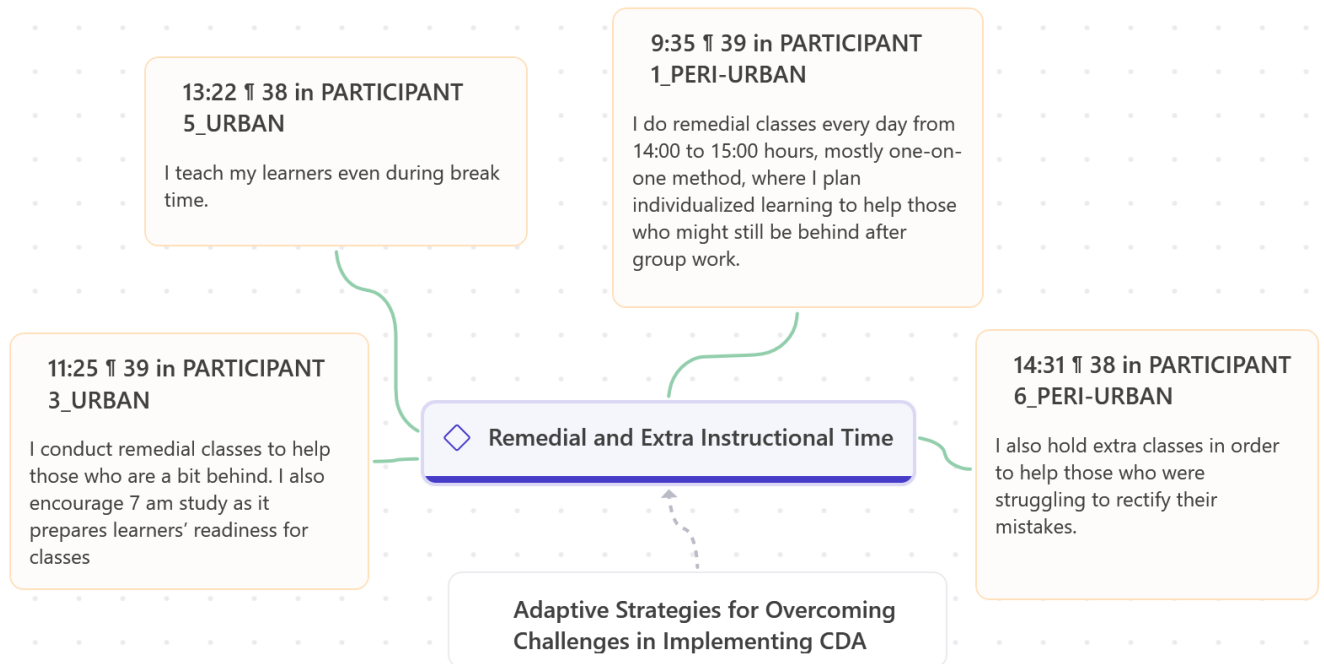


Figure 4.47: Remedial and extra instructional time

Strategic Learner Grouping for Efficient Remediation

This theme delineates the strategic deployment of targeted pedagogical grouping by educators as a core adaptive mechanism to optimise the implementation of Cognitive Diagnostic Assessment (CDA) and enhance the efficiency of subsequent remedial instruction (see Figure 4.48). The data indicates that this practice is consciously employed to mitigate instructional burdens while preserving diagnostic intent.

The formation of these groups is explicitly driven by data derived from CDA, moving beyond arbitrary or social considerations to a focus on shared cognitive deficits. This diagnostic-driven methodology is articulated by one participant: *“Grouping learners. I looked at the cognitive skills that my learners did not master, and then I grouped those learners”* (P1PU). The primary utility of this strategy is its capacity to maximise instructional efficiency, a benefit directly noted by practitioners: *“This has helped me to teach many learners within a short period”* (P1PU).

Beyond efficiency, the strategy is recognised for its positive impact on classroom dynamics, fostering engagement and ensuring inclusivity. As one teacher explained, *“Through grouping methods, I let learners work in groups. Also, engaging every learner in any task conducted in class really assisted a lot”* (P2U). The prevalence of this tactic is well-established across the participant cohort, with statements such as *“I also do group work more frequently”* (P3U) underscoring its integration into standard practice.

A critical finding is the role of grouping in directly ameliorating teacher workload and cognitive fatigue, thereby enhancing the sustainability of CDA. Participants directly linked the practice to reduced pressure: *“Also, grouping learners reduces the load of work. It makes CDA less tiring”* (P5U). This operates on the principle of addressing common errors collectively rather than through exhaustive individual remediation, as detailed in the statements: *“I group learners with the same mistakes together, so that I can address them. This helps me to minimize my work...”* (P6PU) and *“I group learners to reduce the number. Those lacking the same skill are grouped”* (P7PU).

In summation, strategic, data-informed grouping emerges not merely as a classroom management technique but as a sophisticated, scalable pedagogical technology. It enables teachers to reconcile the intensive, individualised focus demanded by CDA with the logistical realities of large-class

teaching, effectively maintaining a targeted instructional focus while distributing pedagogical resources more efficiently.

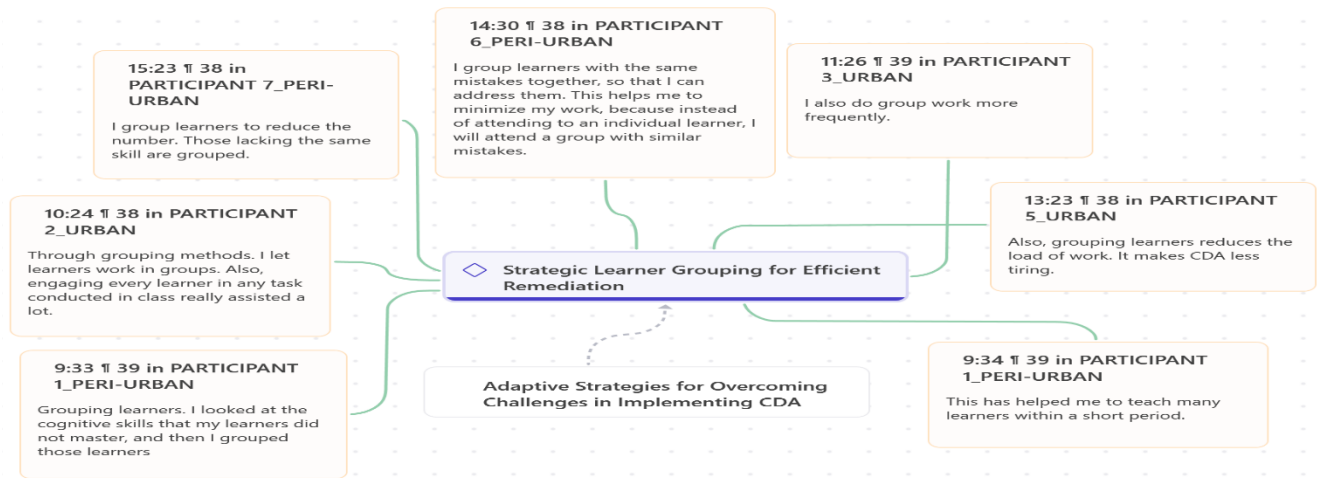


Figure 4.48: Strategic learner grouping or efficient remediation

ALIGNING CDA WITH CURRICULUM AND INSTRUCTIONAL OBJECTIVES

A pivotal finding of this research is the deliberate and strategic integration of Cognitive Diagnostic Assessment (CDA) by practitioners into their instructional design to ensure rigorous coherence with national curriculum goals (see Figure 4.49). This theme moves beyond the perception of CDA as a mere evaluative tool, repositioning it within teachers' praxis as a fundamental and natural extension of the curriculum itself. Teachers, as the data reveals, consciously harness CDA not only to gauge learner mastery of stipulated skills and concepts but also as a critical feedback mechanism to reflexively inform and refine their pedagogical strategies, thereby directly aiming to improve learning outcomes. This process of integration is not ad hoc but is characterised by a structured and thoughtful approach, which the analysis delineates into two principal sub-themes.

The first sub-theme, 'Designing CDA Tasks Based on Curriculum Learning Outcomes', highlights a process of deliberate derivation. Here, teachers explicitly anchor their creation of diagnostic tasks in the objectives outlined in national syllabus documents and assessment frameworks. This ensures that the cognitive demands of the CDA tasks are a valid and faithful reflection of the curriculum's intent. Rather than assessing abstract or disconnected skills, teachers craft activities that directly probe the specific competencies learners are expected to master, thereby forging a vital conceptual link between the mandated curriculum and the diagnostic process.

The second sub-theme, ‘Integrating CDA into Instructional Planning and Assessment Cycles’, reveals the embedding of these assessments into the very architecture of teaching practice. CDA is systematically incorporated into the lesson planning phase, signalling its role as a proactive design feature rather than a retrospective add-on. Furthermore, teachers employ these tools formatively at the culmination of instructional sequences. This application serves a dual purpose: it assesses student understanding while simultaneously providing a powerful metric for evaluating the efficacy of the teaching strategies employed. Consequently, CDA becomes an indispensable component in closing the feedback loop between instruction, assessment, and subsequent pedagogical adjustment.

Together, these sub-themes illustrate a sophisticated practitioner understanding of alignment. They demonstrate how teachers operationalise a coherent educational experience by ensuring that assessment, pedagogy, and curriculum are not disparate elements but are intricately and intentionally intertwined. This ensures that diagnostic evaluation is consistently and meaningfully tethered to both the content delivered and the competencies learners are mandated to achieve, ultimately upholding the overarching objectives of the national educational framework.

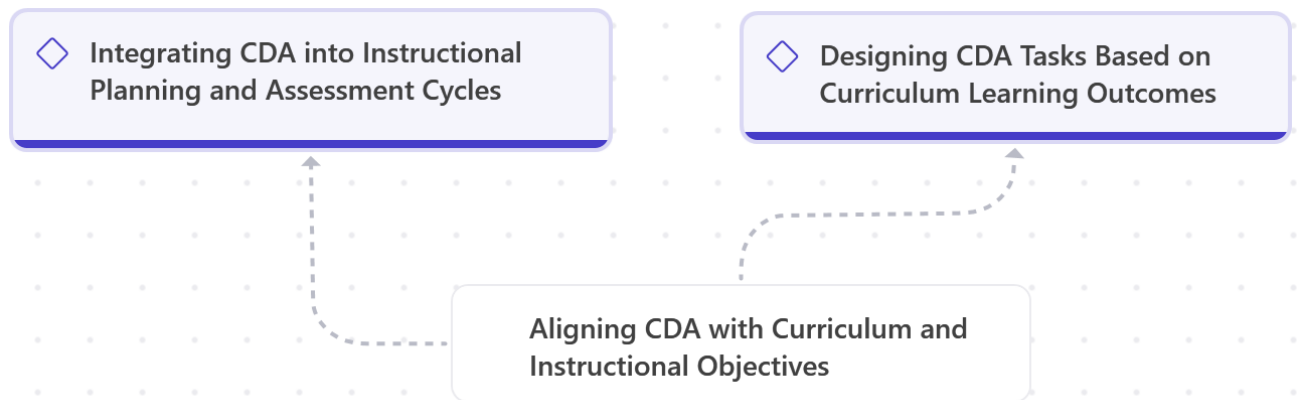


Figure 4. 49: Aligning CDA with curriculum and instructional objectives

Designing CDA Tasks Based on Curriculum Learning Outcomes

This theme extrapolates the deliberate and strategic endeavours of teachers to ensure the precise alignment of Cognitive Diagnostic Assessment (CDA) with mandated curriculum standards and explicit instructional goals (see Figure 4.50). The data reveals a sophisticated practitioner understanding that for CDA to be pedagogically valid and effective, its design must be

fundamentally rooted in the formal learning outcomes prescribed by national educational authorities.

This alignment is operationalised through a systematic process of curriculum review and objective setting. As one participant detailed, the procedure begins with *“I review the learning outcomes (LO) in the syllabus and then state my learning objectives based on those outcomes”* (P1PU), which subsequently informs the design of *“a cognitive test, which assesses those objectives”* (P1PU). This demonstrates a clear, linear progression from curricular mandate to assessment instrument.

A significant finding is the practice of adaptively repurposing standardised assessment materials for diagnostic ends. Participants reported leveraging items from national examinations but critically modifying them to enhance their diagnostic utility. This is evidenced in statements such as, *“I use the ones that have previously been used, like the ones from the Examination Council of Lesotho (ECOL), then I adjust them a little, so that I can assess the skills that I want the learners to master”* (P3U) and *“using national exam questions as a guide but modifying them to probe deeper understanding”* (P4U). This represents a nuanced blend of standardisation and customisation, allowing teachers to target specific cognitive skills while maintaining a connection to external benchmarks.

Furthermore, teachers described a more direct approach of deriving assessment tasks straight from syllabus content, ensuring a tight conceptual coupling. This is reflected in the methods described: *“I take the syllabus, then identify the concepts and skills that I want my learners to master, then design an assessment task that assesses those skills”* (P5U) and *“I just look at the objectives from the curriculum, then design my lessons based on them. At the end of the class, I administer the assessment task to my learners...”* (P6PU). This illustrates a cyclical integration where curriculum dictates instruction, which is then evaluated by an assessment derived from the same curricular source, ensuring profound coherence.

The overarching philosophy of this practice was succinctly captured by a participant who articulated the goal of *“By carefully selecting and using assessments that smoothly reflect cognitive skills that learners are expected to acquire”* (P7PU). Collectively, these responses demonstrate a highly intentional, curriculum-led approach to CDA implementation. This approach not serves to reinforce core learning goals but also generates a more authentic and meaningful

evaluation of learner cognition, thereby bridging the often-theorised gap between assessment design and curricular ambition.

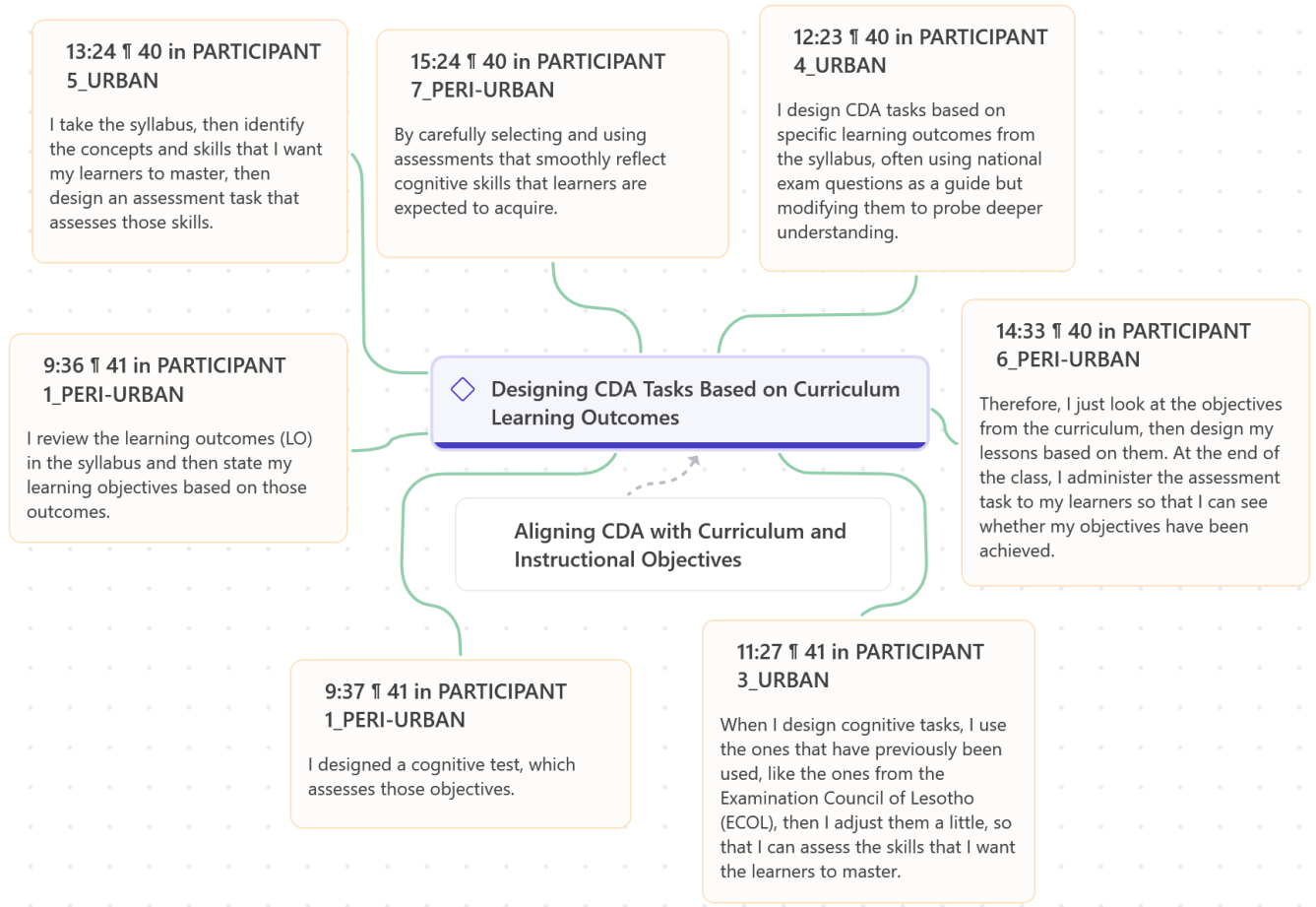


Figure 4. 50: Designing CDA task based on curriculum learning outcome

Integrating CDA into Instructional Planning and Assessment Cycles

This theme expounds upon the deliberate and sophisticated integration of Cognitive Diagnostic Assessment (CDA) by teachers into the holistic teaching and learning process, thereby ensuring a coherent and synergistic relationship between mandated curriculum goals, instructional delivery, and evaluative practices (see Figure 4.51). The data indicates that practitioners conceptualise CDA not as a discrete or ancillary instrument but as an intrinsic and indispensable component of pedagogical planning and classroom-based assessment cycles.

This integrative perspective is fundamentally predicated on a perceived philosophical congruence between the objectives of the national curriculum and the diagnostic function of CDA. One participant articulated this alignment, stating, “*The curriculum enforces teachers to help learners develop skills, knowledge, and a positive attitude towards every concept addressed. So CDA fits accurately as it focuses on identifying strengths and weaknesses and addressing the shortcomings encountered*” (P2U). This sentiment underscores a view of CDA as the logical operationalisation of the curriculum's developmental aims. The compatibility with national standards is further explicitly affirmed by another teacher, who noted, “*CDA aligns well with the Lesotho curriculum, with no difficulty. This is because the curriculum strives for the acquisition of certain skills by the learner*” (P6PU). This suggests that the curriculum's focus on skill acquisition provides a natural framework for diagnostic assessment.

The practical manifestation of this alignment is evidenced in the structural embedding of CDA within the architecture of lesson design. The assessment is positioned as the capstone of a planned instructional sequence, serving a critical formative function. As one teacher detailed, “*I state my objectives in the lesson plan, then I allow teaching and learning to proceed as usual and when it comes to the assessment, this is where I apply CDA to check if the lesson was a success*” (P8PU). This approach exemplifies a closed-loop system where pre-defined learning objectives, derived from the curriculum, directly inform teaching activities, which are subsequently evaluated through a tailored diagnostic tool. The results of this assessment then provide the data necessary to judge pedagogical efficacy and to inform subsequent instructional interventions.

Collectively, these insights demonstrate that CDA is seamlessly woven into both the strategic (planning) and tactical (evaluation) phases of instruction. This integration reinforces its primary role as a dynamic formative mechanism, one that effectively bridges the gap between teaching intentions and learner outcomes, thereby ensuring that assessment is not an endpoint but a vital feedback mechanism within a continuous cycle of pedagogical refinement and curriculum actualisation.

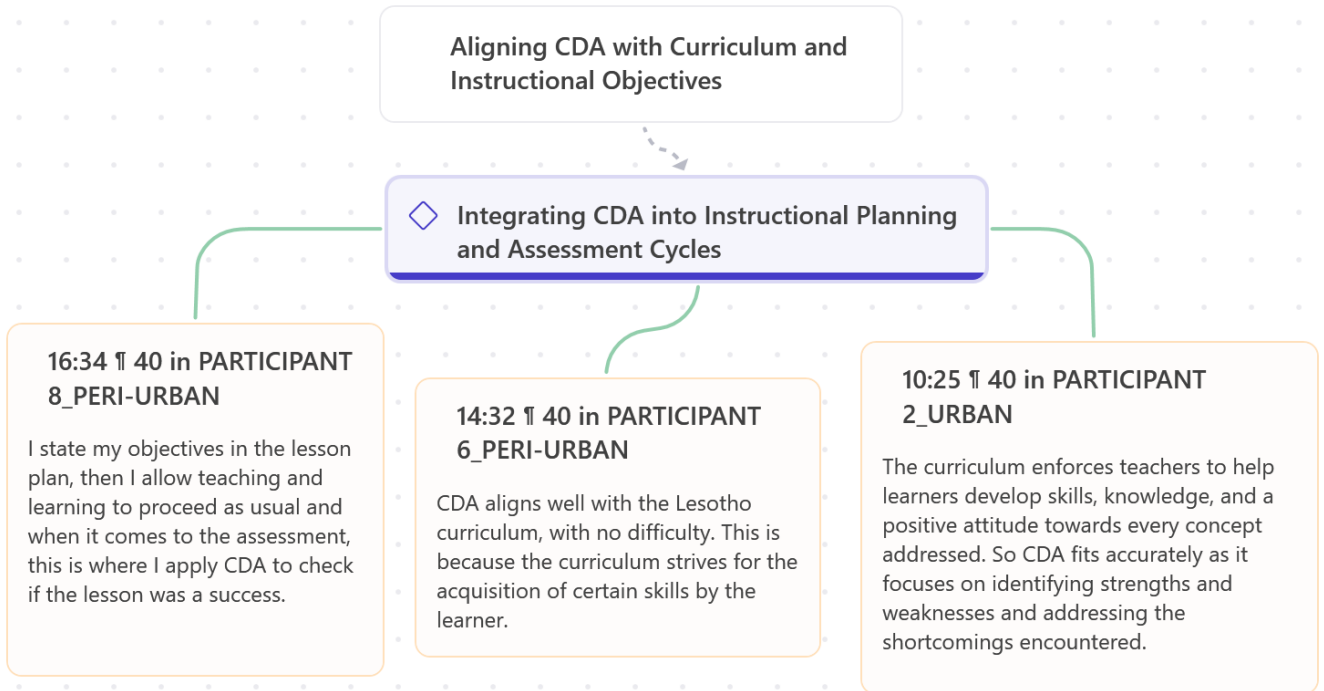


Figure 4.51: Integrating CDA into instructional planning and assessment cycles

COLLABORATIVE PRACTICES TO ENHANCE THE IMPLEMENTATION OF CDA

This theme underscores the pivotal function of collaborative professional engagement in fortifying the implementation and efficacy of Cognitive Diagnostic Assessment (CDA) (see Figure 4.52). The data indicates that teachers actively eschew working in isolation, instead cultivating professional interactions that facilitate the development of a shared epistemological framework, collective problem-resolution, and a standardised application of diagnostic methodologies. This collaborative imperative is analytically delineated through two constitutive sub-themes.

The first sub-theme, Peer Observation and Consultation for Professional Learning, elucidates the processes through which practitioners engage in vicarious and dialogic learning. Teachers systematically observe colleagues implementing CDA within authentic classroom contexts, thereby gaining applied, procedural knowledge. Furthermore, they proactively consult with peers to garner insights into learners' extant knowledge structures and cognitive profiles, thereby enriching their own diagnostic acumen and instructional planning.

The second sub-theme, Regular Collaborative Meetings for Shared Reflection and Planning, highlights the institutionalisation of structured, recurrent forums for professional discourse. Within these meetings, educators engage in critical reflection on implementation challenges, engage in

the reciprocal sharing of material and strategic resources, and collaboratively design pedagogical approaches for the effective integration of CDA. This practice transforms individual experiential knowledge into a collective, refined body of professional practice.

In concert, these collaborative mechanisms cultivate a supportive professional ecology that significantly augments both the calibre and uniformity of diagnostic assessment practices across instructional settings. This, in turn, promotes a more coherent and reliable approach to identifying and addressing learner cognitive needs.

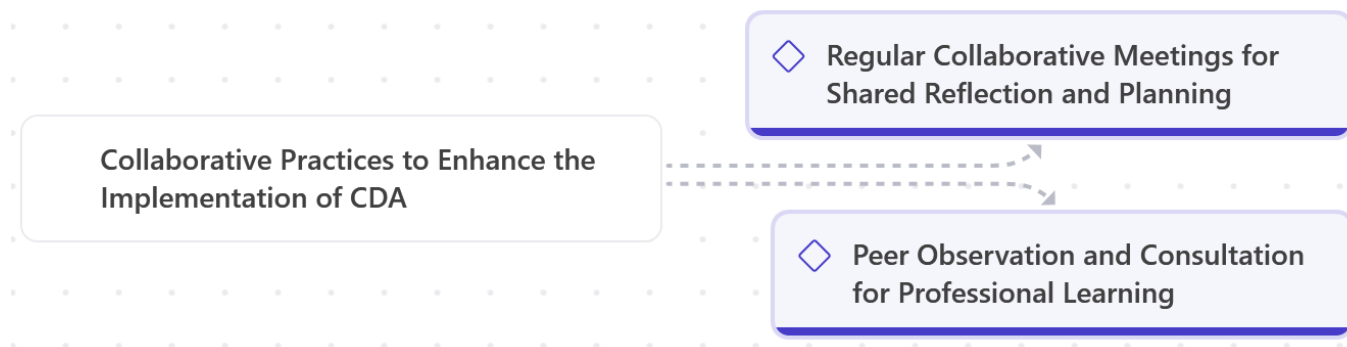


Figure 4.52: Collaborative practices to enhance the implementation of CDA

Peer Observation and Consultation for Professional Learning

This sub-theme elucidates the proactive engagement of teachers in structured collaborative practices to augment the efficacy and fidelity of their Cognitive Diagnostic Assessment (CDA) implementation (see Figure 4.53). Participants consistently emphasised the instrumental value of collegial learning, achieved through both formal and informal professional interactions, as a critical mechanism for professional development and standardisation of practice.

The data reveals a strategic use of collaboration to acquire essential pedagogical knowledge, particularly concerning learners' pre-existing cognitive frameworks. This is exemplified by one participant's approach to diagnostic sequencing: *“Consult other teachers to know what learners did previously, so that I can know where and how to start, based on what learners already know”* (P7PU). This practice ensures that instructional starting points are informed by accurate assessments of prior learning, thereby increasing the diagnostic validity of subsequent CDA activities.

Furthermore, the findings indicate that teachers actively seek out opportunities for vicarious learning through direct classroom observation. As one participant stated, *“I observe other teachers*

in their classrooms when they use CDA in their classrooms” (P8PU). This practice of observing modelling from peers provides practitioners with tangible, contextually embedded exemplars of CDA strategies, which they can then adapt and refine within their own pedagogical repertoires. Collectively, these insights demonstrate that peer-based professional learning functions not merely as a peripheral support mechanism but as a fundamental, practice-oriented modality for building collective capacity. It fosters a shared understanding and promotes a greater consistency in the application of CDA methodologies across different classroom environments, thereby enhancing the overall robustness of the diagnostic process within the educational setting.

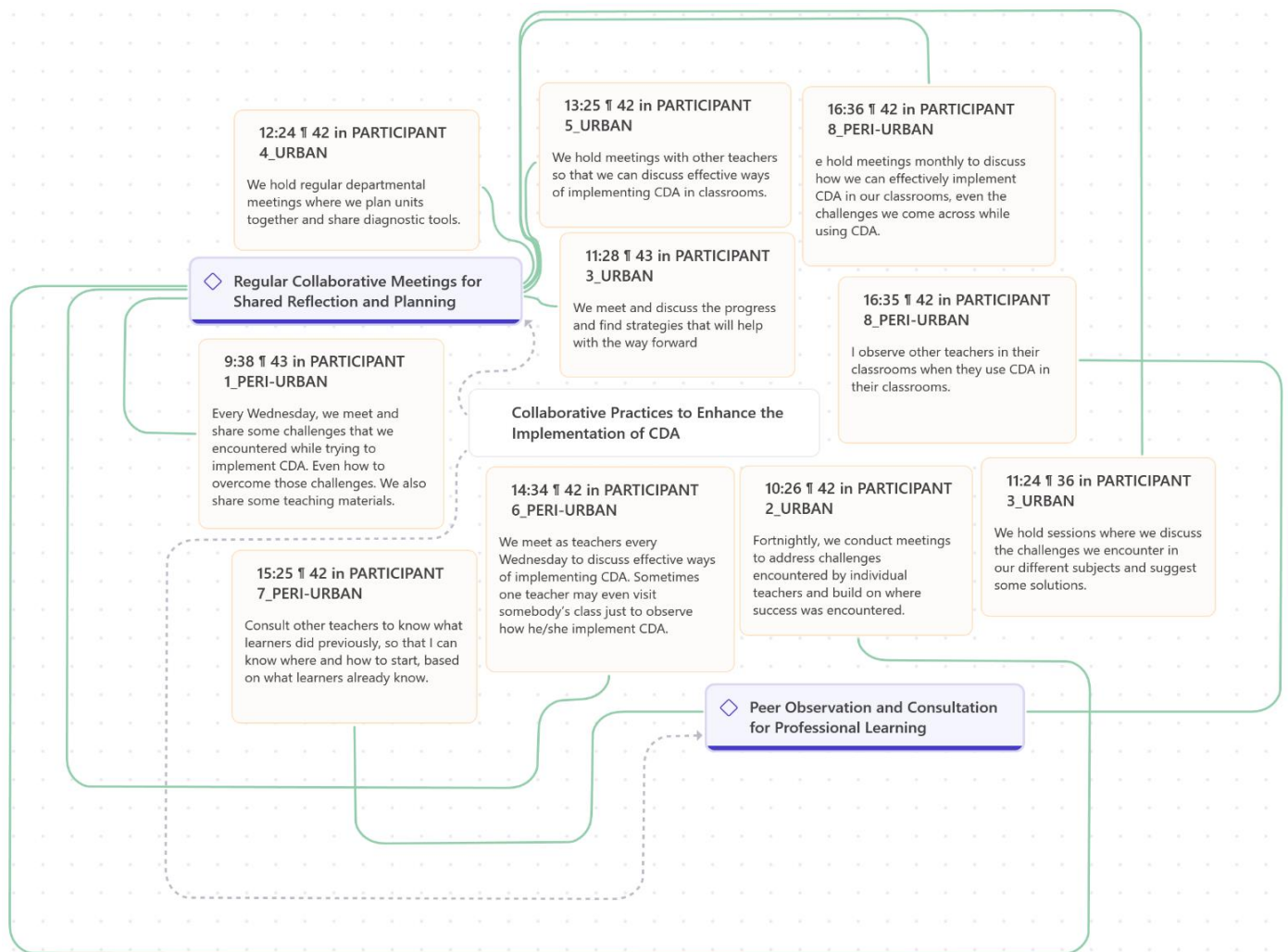


Figure 4.53: Collaborative practices to enhance the implementation of CDA

Regular Collaborative Meetings for Shared Reflection and Planning

This sub-theme underscores the critical function of structured professional collaboration in facilitating the robust implementation of Cognitive Diagnostic Assessment (CDA). Data from multiple participant contexts indicates that institutionalised collaborative forums convening on a weekly, fortnightly, or monthly basis serve as pivotal mechanisms for fostering shared epistemological development, collective problem-resolution, and the refinement of diagnostic pedagogy. These scheduled interactions provide a formalised space for critical reflection on implementation challenges, the reciprocal exchange of pedagogical resources, and the co-construction of diagnostic instruments.

The efficacy of this structured collegiality is evidenced in participant testimony. One teacher detailed a systematic approach: *“Every Wednesday, we meet and share some challenges that we encountered while trying to implement CDA. Even how to overcome those challenges. We also share some teaching materials”* (P1PU). This highlights a dual focus on both dissecting problems and proactively generating solutions. Similarly, another participant emphasised the integration of CDA into curriculum planning processes: *“We hold regular departmental meetings where we plan units together and share diagnostic tools”* (P4U), demonstrating how diagnostic practice is embedded within broader instructional design.

These collaborative engagements transcend mere logistical coordination, cultivating a professional learning community characterised by mutual support and observational learning. As one teacher elaborated, *“We meet as teachers every Wednesday to discuss effective ways of implementing CDA. Sometimes one teacher may even visit somebody’s class just to observe how he/she implement CDA”* (P6PU). This practice of peer observation, emerging from collective discourse, provides authentic, contextualised models for refining individual practice.

In summation, such organised collective reflection and planning serve to deepen pedagogical content knowledge specific to diagnostic processes. Furthermore, they promote a greater standardisation and contextual responsiveness in the application of CDA across diverse classrooms, thereby enhancing both the fidelity and adaptive quality of its implementation.

CHAPTER FIVE

DISCUSSION ON FINDINGS

5.0 Introduction

This chapter presents a detailed discussion of the study's principal findings, which investigated the lived experiences of teachers in implementing Cognitive Diagnostic Assessment (CDA) within their classroom environments. The discussion is systematically structured around the three research questions that guided the inquiry. Each respective section undertakes a critical synthesis of the emergent empirical results, deliberately integrating them with the extant body of empirical literature reviewed in Chapter Two. This integrative approach serves to contextualise the new findings within established scholarly discourse, highlighting points of convergence, divergence, and the novel contributions this study makes to the field of diagnostic assessment practices.

Research question 1: What are the experiences of practicing teachers regarding the implementation of CDA in their classrooms?

The empirical findings of this study compellingly demonstrate that the adoption of Cognitive Diagnostic Assessment (CDA) precipitated a significant reorientation in pedagogical practice, catalysing a shift towards a more reflective, responsive, and fundamentally learner-centred paradigm. Practitioners reported developing a markedly heightened awareness of individual learner profiles, which in turn empowered them to tailor instruction, deliver targeted support, and strategically differentiate tasks to accommodate specific cognitive needs and abilities. This evolution is poignantly captured in the participant's assertion that, "*Knowing where each learner struggles has helped me to adjust my lessons so that where remediation is needed, I can be able to do...*" This transition towards a more differentiated and adaptive pedagogy finds strong resonance in the established literature, corroborating the work of Shi et al. (2024), Puente et al. (2023), Kim (2015), and Toprak and Cakir (2021), all of whom identified CDA as a potent mechanism for precisely identifying cognitive strengths and weaknesses to inform instructional adjustments. Similarly, the capacity to understand learners' developmental trajectories, as noted by Peng et al. (2023), was affirmed as a critical factor in the design and refinement of both curriculum and teaching strategies.

A further salient motivation for CDA adoption identified within the data was its intrinsic alignment with both national curriculum mandates and the core principles of formative assessment in the Lesotho context. Teachers perceived CDA as a practical instrument for facilitating the achievement of stipulated lesson objectives and for enhancing learner engagement and conceptual mastery, thereby substantiating the assertions of Prihartono and Rustam (2020). Furthermore, a powerful driver for its integration was the professed desire to identify and remediate individual learning gaps a finding that directly echoes the conclusions drawn by Bangeranye and Lim (2020), He et al. (2021), and Hadi et al. (2025).

The application of CDA extended to the diagnosis of subject-specific challenges, underscoring its disciplinary versatility. For example, one science teacher described recalibrating instruction in response to identified difficulties in measuring organic matter, an application paralleling the subject-specific diagnostic processes described by Chi et al. (2022) and Ranjberan and Alavi (2017). Concurrently, CDA proved effective in unveiling foundational literacy and numeracy deficits, such as decoding difficulties or limited vocabulary, consistent with the findings of Haghayeghi et al. (2024), Delga (2019), Abbood et al. (2025), and Qi et al. (2024). However, while this subject-specific adaptability constitutes a notable strength, it inherently presupposes that teachers possess sophisticated diagnostic interpretation skills an assumption that cannot be uniformly applied across all practitioners and which may, therefore, circumscribe its overall impact. Moreover, the long-term sustainability of such intensive, diagnostic-driven strategies remains potentially precarious, threatened by pervasive workload pressures and systemic resource limitations.

A final, significant outcome was the reported positive transformation in teaching and learning dynamics. Participants indicated that CDA engendered improvements in lesson planning efficacy, learner engagement, and academic performance, aligning with the observations of Sun and Hwang (2023) and Huang (2022). This enhancement was achieved through the acquisition of clearer, more granular insights into learner abilities, which enabled more intentional and targeted instructional planning. Reported strategies for seamless integration included the embedding of diagnostic moments within lesson flow, the meticulous alignment of assessment tasks with learning objectives (cf. Romiah et al., 2025; Li et al., 2021; Reinita & Syahroh, 2024), and the deployment

of varied pedagogical tools such as peer learning and educational games, the latter finding support in the work of Wu (2024).

Research Question 2: How do practicing teachers perceive the effectiveness of CDA in improving their classroom assessment practices?

A critical finding of this research is that teachers perceived Cognitive Diagnostic Assessment (CDA) as substantially superior to traditional summative assessment paradigms, a perception grounded in its diagnostic granularity and its capacity to generate timely, actionable feedback. This view was cogently summarised by one participant, who emphasised that CDA furnishes a comprehensive understanding of *"what learners know, what they do not know, and how they learn best."* This triangulation of learner cognition aligns with the empirical work of Chin and Chew (2021) and Wu (2019), the latter of whom quantitatively demonstrated that tutoring interventions informed by CDA diagnostics yielded significantly better outcomes than traditional remedial approaches, particularly for medium- and low-achieving cohorts.

A paramount advantage repeatedly emphasised was CDA's facilitation of real-time feedback, a feature that starkly contrasts with the delayed reporting characteristic of conventional assessments, which often renders intervention obsolete. This finding substantiates the conclusions of Gan et al. (2019), Chuan et al. (2023), Sujinah et al. (2024), and Chin et al. (2020), all of whom observed that immediate, finely detailed feedback is a prerequisite for responsive pedagogical adjustment and the maintenance of sustained learner engagement.

Beyond its immediacy, CDA was valorised as a transformative formative instrument that recalibrated teachers' assessment philosophies, granting unprecedented insights into latent cognitive processes and thereby facilitating truly personalised instructional planning. This outcome corroborates the findings of Sia and Lin (2018) and Mirzaei et al. (2020). A noteworthy divergence from the literature emerged, however, regarding higher-order thinking skills. While Monarrezzo and Tchoshanou (2020) cautioned that CDA frameworks may not inherently support their assessment, participants in this study reported deliberately aligning diagnostic questions with targeted higher-order competencies, suggesting that its efficacy in this domain is contingent upon the sophistication of its design and the intentionality of its implementation, rather than an inherent limitation.

Furthermore, the diagnostic utility of CDA extended beyond the identification of deficits to the recognition and cultivation of latent strengths, a finding consistent with the research of Wafa et al. (2020), Wu et al. (2025), Xu et al. (2020), and Huan and Chin (2022). For instance, one participant astutely identified that although a final answer was incorrect, the learner exhibited proficiency in a subsidiary skill, such as answer simplification, which could be strategically reinforced. Moreover, CDA was perceived as a potent catalyst for deep conceptual understanding, compelling learners to transcend rote memorisation and engage in critical thinking and application, a process detailed by Huan and Chew (2022). Nevertheless, the long-term sustainability of such conceptual growth absent systemic institutional reinforcement presents a salient area for further inquiry.

Finally, teachers underscored CDA's profound impact on the affective dimensions of learning, noting its role in fostering heightened learner engagement, empowerment, and metacognitive independence. This resonates with the work of Hasibuan et al. (2024), Junpeng et al. (2020), and Huan et al. (2021). The provision of detailed feedback enabled teachers to design precise remedial support (Zhang et al., 2024), while simultaneously empowering learners to assume greater ownership of their learning trajectories a phenomenon corroborated by Hamza and Touhami's (2024) findings on enhanced learning confidence and attenuated test anxiety.

Question 3 (a); What are the main challenges faced by practicing teachers when integrating CDA into classroom practice?

The findings of this study indicate that, whilst Cognitive Diagnostic Assessment (CDA) was widely perceived as beneficial for enriching formative assessment practices and enhancing learner outcomes, its full integration into classroom practice was significantly impeded by a constellation of contextual challenges. These impediments were predominantly systemic in nature, intersecting pervasively with the daily realities of teaching in manners that substantially constrained the consistent and effective application of CDA principles.

A foremost impediment identified was the insufficiency of training and the scarcity of material resources. The data reveal that whilst the initial CDA training provided was perceived as useful, its duration was inadequate and its conceptual depth insufficient to foster sustained, sophisticated implementation. A critical deficit in ongoing, follow-up professional development left many practitioners struggling to translate introductory principles into durable, contextually responsive classroom strategies. Compounding this was a chronic shortfall in essential teaching aids, purpose-built assessment tools, and adequate physical infrastructure. This aligns with the conclusions of

Noh et al. (2024) and Lee (2015), who identified inadequate professional development and material provision as fundamental barriers to the effective operationalisation of CDA. Within the Lesotho context, these findings corroborate concerns raised by Rakolobe (2024) and Kurata et al. (2022) regarding chronic underfunding and logistical impediments within the education sector. It is noteworthy, however, that a contrary perspective within the literature, exemplified by Harris and Brown (2021), posits that resource constraints need not entirely preclude CDA adoption, suggesting that teacher ingenuity and adaptability can facilitate meaningful implementation. Nevertheless, such agency-dependent strategies invariably demand exceptionally high levels of practitioner resilience and innovation.

Furthermore, considerable challenges arose from pronounced learner diversity coupled with excessively large class sizes. Teachers reported grappling with the formidable task of delivering personalised, diagnostic feedback in environments characterised by vast disparities in learner ability and exacerbated behavioural issues due to overcrowding. Under these conditions, the equitable allocation of teacher attention became practically unattainable; managing focused small-group diagnostics frequently resulted in the neglect of other pupils, precipitating classroom disruptions. These observations are consistent with the work of Emmanuel and Ekpo (2021) and Javidanmehr et al. (2017), who found that large class sizes directly inhibit the capacity for individualised feedback. This is further supported by Chin and Chew (2023), who emphasise the complications heterogeneous classrooms pose for differentiated instruction. In Lesotho, despite the Lesotho Education Broadcasting Curriculum Policy (LEBCP) advocating a teacher student ratio of 1:30, World Bank (2019) data confirm that class sizes, particularly in peri-urban areas, frequently exceed this threshold. Paradoxically, it must be acknowledged that CDA, if adequately supported, theoretically offers methodologies such as needs-based grouping informed by diagnostic feedback to better manage diversity. Thus, whilst large classes present a profound practical challenge, CDA could potentially form part of a strategic solution, contingent upon the provision of appropriate structural and pedagogical scaffolding.

An additional, and deeply interlinked, constraint was the intense pressure of time and the already onerous teacher workload. Participants consistently characterised CDA as a profoundly time-intensive undertaking, necessitating considerable investment in the design, administration, marking, and nuanced interpretation of diagnostic tasks. This additional burden, superimposed upon existing teaching, administrative, and extracurricular duties, frequently rendered the

profound feedback processes central to CDA unfeasible. This reflects the findings of Matore and Noh (2023), Meisuri and Ekayati (2023), Ramdan et al. (2024), and Javidanmehr and Sarab (2017), all of whom underscore the substantial temporal demands of diagnostic assessment. Furthermore, Paris (2022) and DeLuca et al. (2024) similarly observed that the provision of timely, meaningful feedback is routinely compromised by competing professional obligations. A mitigating perspective is offered by DeLuca et al. (2019), whose research suggests that as practitioners gain experience with CDA, they develop more efficient processes and routines, thereby reducing the time burden over the long term. This implies that whilst temporal constraints constitute a legitimate initial barrier, they may be ameliorated through accumulated familiarity and the systematisation of practice.

Critically, within the purview of this study, these challenges are not discrete but are intrinsically synergistic and mutually reinforcing. Inadequate training and resource scarcity diminish the capacity to address learner diversity within overcrowded classrooms, which in turn exacerbates time pressures and intensifies workload demands. Although countervailing arguments within the scholarship suggest that teacher adaptability and prospective efficiency gains might alleviate some of these pressures, the structural realities of Lesotho's education system specifically, persistent resource shortfalls and systemic staffing constraints render such individualistic solutions insufficient in isolation. For CDA to be sustainably embedded as a transformative pedagogical practice, a concerted, multi-faceted strategy is imperative. This must encompass comprehensive, continuous capacity-building programmes, the targeted provision of resources, and substantive systemic reforms addressing class sizes and equitable workload distribution. Absent such foundational measures, CDA risks being perceived not as a catalytic tool for improving learning outcomes, but rather as an unsustainable additional burden imposed upon an already overstretched profession.

Question 3. (b) What strategies do they employ to address these challenges?

The findings of this study extrapolate that, notwithstanding considerable systemic impediments including resource limitations, substantial class sizes, and excessive workloads educators demonstrated remarkable adaptability and agency in their endeavours to integrate Cognitive Diagnostic Assessment (CDA) into their pedagogical practice. Their approaches encompassed a suite of strategic adaptations: the inventive utilisation of low-technology resources, flexible instructional planning, deliberate curriculum alignment, collaborative professional engagement,

and the implementation of targeted learner grouping to optimise instructional efficacy and enhance learner outcomes.

A principal adaptive strategy involved the deployment of low-technology and readily accessible materials. In environments lacking advanced technological infrastructure, practitioners relied on extant resources such as printed materials, internet-sourced assessment tasks, and direct observational techniques to gauge learner performance. This resonates with the assertions of Mohd Matore et al. (2024), who posit that low-tech solutions can reduce implementation complexity without fundamentally compromising the diagnostic integrity of CDA. Nevertheless, this approach is not without its limitations; as Liu et al. (2017) caution, the diagnostic accuracy of such methods may be constrained in contexts requiring sophisticated analytical tools. Within the Lesotho setting, however, where digital solutions are often unviable, this pragmatic recourse afforded a feasible means of sustaining diagnostic functions.

Teachers further exhibited flexibility through creative workarounds designed to mitigate the temporal and material demands of CDA. Some reported retrofitting existing summative assessment tasks by modifying them to target specific cognitive skills, a strategy that aligns with Noh and Matore's (2024) observation that adapting available resources can conserve time and alleviate workload pressures. However, as Liu et al. (2017) warn, the validity of such adaptations is contingent upon their careful alignment with diagnostic objectives. Others reconfigured lesson structures to incorporate brief, focused intervals for instance, dedicating ten minutes per session to diagnostic monitoring, a practice corroborated by Kholid et al. (2024), who emphasise the efficacy of strategic time allocation in differentiated instruction. This incremental approach proved particularly salient in overcrowded classrooms, where extended individual assessment is often impracticable.

Notably, the findings indicate minimal institutional or collegial resistance to CDA adoption, with only isolated instances of scepticism reported. In such cases, CDA was perceived as superfluous to core teaching duties, and administrative priorities often favoured reporting metrics over diagnostic insights. Social Cognitive Theory (Bandura, 1986) provides a useful framework here: the normalisation and modelling of CDA within supportive professional environments appear to bolster teacher self-efficacy and adoption rates. The predominantly positive collegial climate observed in this study suggests a conducive environment for collective refinement of practice.

To address persistent systemic barriers, teachers engaged in collaborative support and resource optimisation. Inter-teacher cooperation manifested through the sharing of materials, co-construction of assessments, and pooling of strategies served to distribute workload and enhance the quality of diagnostic practices. This finding aligns with Dewi (2024), who highlights the role of professional networks in sustaining assessment innovation. Within Lesotho, such collaborative cultures represent a critical mechanism for scaling CDA implementation, particularly in resource-constrained settings.

The strategic grouping of learners based on diagnostic data emerged as another prevalent tactic for streamlining remediation efforts. Teachers used CDA outcomes to cluster learners with comparable skill gaps, thereby facilitating more efficient, targeted instruction. This approach is consistent with the research of Helm et al. (2023) and Mei and Chen (2022), who found that data-informed grouping enhances instructional precision while mitigating teacher burden. Such practices also align with the intervention objectives outlined in the Lesotho Education Blueprint (LEBCP), enabling more responsive support for struggling learners.

Crucially, teachers perceived CDA not as an adjunct to the curriculum but as an integral component of instructional design and delivery. They derived assessment tasks directly from prescribed learning outcomes, ensuring close alignment between diagnostic objectives and curricular expectations. This reflects the emphasis placed by Huan et al. (2021) and Le et al. (2024) on the importance of curriculum-embedded assessment for maintaining validity and pedagogical coherence. Moreover, the incorporation of CDA into routine teaching cycles encompassing design, feedback, remediation, and validation echoes the iterative model advanced by Fan et al. (2021).

Collaborative professional learning practices further emerged as a critical enabler of CDA implementation. Peer observation provided opportunities for vicarious learning, reinforcing Bandura's emphasis on modelling as a mechanism for building self-efficacy. Regular collaborative meetings fostered collective reflection, problem-solving, and resource exchange practices endorsed by Noh and Matore (2024) and Kholid et al. (2024) as essential for sustaining pedagogical innovation.

In summary, these adaptive strategies illustrate that, although systemic constraints present formidable challenges, they are not insuperable. The ingenuity exhibited by teachers in leveraging available tools, aligning assessment with curricular aims, engaging in collaboration, and

reengineering instructional delivery reflects a proactive and resourceful approach to pedagogical problem-solving. However, the long-term sustainability of these practices hinges on robust institutional reinforcement, including continuous professional development, targeted resource allocation, and committed administrative support. Absent such structural underpinnings, the scalability of CDA in Lesotho may remain contingent upon the extraordinary efforts of individual practitioners, rather than becoming an entrenched feature of systemic educational practice.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION, RECOMMENDATIONS, LIMITATIONS AND FUTURE DIRECTIONS

6.0 Introduction

This chapter provides a comprehensive synthesis of the study's principal findings, systematically organised around the core research questions and the overarching thematic patterns that emerged from the rigorous analysis of qualitative data. It advances the thesis by critically interpreting these findings within the broader context of existing scholarly literature on Cognitive Diagnostic Assessment (CDA) and teacher implementation. Subsequently, the chapter delineates the theoretical, practical, and policy implications arising from the evidence. It culminates in a set of cogent conclusions and targeted recommendations for stakeholders, whilst also explicitly acknowledging the study's inherent limitations and proposing constructive avenues for future scholarly inquiry.

6.1 Summary of Findings

This study investigated the lived experiences of teachers in implementing Cognitive Diagnostic Assessment (CDA) within their classroom environments. The research focused specifically on the practical application of CDA, teachers' perceptions of its utility and challenges, and the strategies employed to sustain its use within contexts characterised by significant operational constraints. The investigation sought to understand not only the phenomenological aspects of CDA adoption but also the complex interplay between pedagogical innovation and systemic limitations that shape implementation realities.

Research Question 1: Experiences of Practising Teachers with CDA Implementation

The implementation of Cognitive Diagnostic Assessment (CDA) engendered a significant deepening of teachers' awareness of individual learner profiles, thereby facilitating the identification of specific cognitive strengths, weaknesses, and learning needs. This enhanced diagnostic capacity fostered a shift towards more individualised instruction and consistently learner-centred pedagogical approaches.

Teachers' motivation to integrate CDA was underpinned by its perceived alignment with both the objectives of Lesotho's national curriculum and the principles of formative assessment, coupled with a professional commitment to addressing the unique educational requirements of their students. Notwithstanding these intentions, significant impediments to implementation were encountered. These included insufficient professional training, a lack of appropriate resources, severely overcrowded classrooms, and pervasive time constraints arising from already excessive workloads. Despite these substantial contextual challenges, teachers reported that the use of CDA contributed to measurable improvements in instructional planning, enhanced responsiveness to learner needs, and increased levels of student engagement. Successful integration was achieved through several key strategies: the embedding of continuous assessment practices directly tied to learning objectives, the strategic grouping of learners based on diagnostic data, and the adoption of interactive, engaging pedagogical approaches designed to operationalise diagnostic insights.

Research Question 2: Perceived Effectiveness of CDA in Improving Assessment Practices

Teachers perceived Cognitive Diagnostic Assessment (CDA) as markedly superior to conventional summative assessment methods, owing to its capacity to generate timely, formative feedback and furnish granular diagnostic insights into learner cognition. This diagnostic precision enabled educators to craft purposeful questioning strategies, accurately identify specific misconceptions, and formulate instructionally tailored responses to address individual learning gaps.

Furthermore, the implementation of CDA was reported to significantly enhance the development of learners' critical thinking faculties, promote deeper conceptual engagement, and foster a greater sense of metacognitive awareness and academic empowerment among students. The assessment framework thereby transcended mere evaluation, evolving into a transformative pedagogical tool that actively cultivated intellectual autonomy and rigorous cognitive development.

Research Question 3a: Challenges Faced in CDA Integration

Findings indicate that teachers identified insufficient professional development, a dearth of appropriate resources, excessively large class sizes, and unsustainable workload demands as the most significant structural impediments to effective implementation. While the majority of participants reported an absence of overt opposition from colleagues or administrative leadership, a minority cited instances of scepticism, particularly in cases where Cognitive Diagnostic Assessment (CDA) was perceived not as a pedagogical enhancement but as an ancillary burden divorced from core teaching responsibilities and exacerbating existing time pressures. This perception underscores a critical disconnect between the theoretical value of diagnostic assessment and the practical realities of classroom and institutional constraints.

Research Question 3b: Strategies to Overcome Challenges

Teachers enacted a range of adaptive strategies to facilitate the implementation of Cognitive Diagnostic Assessment (CDA) amidst constraining operational conditions. These measures included the cultivation of collaborative professional networks for mutual support and resource sharing, the strategic grouping of learners informed by diagnostic data to enable targeted remediation, and the deliberate alignment of CDA tasks with prescribed curriculum objectives to ensure pedagogical coherence.

Furthermore, teachers actively participated in structured collegial activities such as peer observation and regular departmental meetings which served as forums for the critical exchange of diagnostic tools, the collective analysis of student outcomes, and reflective dialogue on teaching practices. These collaborative mechanisms not enhanced individual implementation capacity but also fostered the development of a shared professional culture oriented towards diagnostic pedagogy and iterative instructional improvement.

6.2 Implications

For teaching practitioners, Cognitive Diagnostic Assessment (CDA) provides a structured and empirically grounded methodology for the identification and remediation of learning deficits in real-time, thereby facilitating a more responsive and differentiated pedagogical approach.

For policy-makers, notably the Ministry of Education and Training (MOET), these findings underscore the strategic imperative of institutionalising CDA within national assessment policy and systemic professional development frameworks. Such integration would legitimise its use and provide the necessary structural support for effective implementation.

Concomitantly, the National Curriculum Development Centre (NCDC) is positioned to play a pivotal role by embedding the core principles of CDA into both curriculum architecture and initial teacher education programmes. This would ensure a coherent and consistent application of diagnostic practices across the national educational landscape, bridging the gap between curricular intent and classroom-level assessment.

6.3 Conclusion

This study reveals that the implementation of Cognitive Diagnostic Assessment (CDA) catalyses a significant paradigm shift in pedagogical orientation, moving practice away from traditional, summative, and score-driven evaluation toward a more reflective, responsive, and fundamentally learner-centred teaching model. The diagnostic capacity of CDA fostered among teachers a heightened metacognitive awareness of individual learner profiles, enabling a data-informed recalibration of instructional planning and the provision of targeted, differentiated support.

Whilst significant systemic challenges persist notably pertaining to resource limitations, temporal constraints, and suboptimal pupil-to-teacher ratios the empirically observed adaptive and agentic strategies deployed by practitioners confirm that the meaningful integration of CDA remains an attainable objective. However, its sustainability and scalability are contingent upon the provision of robust institutional scaffolding, including comprehensive professional development, strategic resource allocation, and policy reforms designed to ameliorate implementation barriers.

6.4 Recommendations for research, practice and policy

Based on the findings, the following practicable recommendations are proposed:

1. Strengthen CDA Training and Professional Development
 - The MOET, in collaboration with NCDC, should provide continuous in-service training on CDA design, administration, and data interpretation.
 - Training should include practical classroom-based workshops and peer learning sessions.
2. Promote Collaborative Teacher Networks
 - Schools should establish CDA-focused communities of practice where teachers share diagnostic tools, discuss case studies, and observe each other's lessons.

- Departmental meetings should include dedicated time for collaborative CDA planning.
3. Leverage Low-Tech and Readily Available Resources
- Teachers should be encouraged to use observation checklists, adapted worksheets, and verbal questioning when technology is unavailable.
 - The MOET could compile a national repository of CDA-aligned tasks accessible to all teachers.
4. Integrate CDA into Lesson Planning and Curriculum
- Teachers should align CDA tasks directly with syllabus objectives to ensure assessments measure intended skills.
 - The NCDC should embed CDA strategies within curriculum guides and scheme-of-work templates.
5. Encourage Strategic Learner Grouping for Remediation
- Teachers should use CDA results to group learners with similar learning needs for targeted intervention.
 - Group work should be structured to reduce workload while maximising personalised support.
6. Allocate Dedicated Time for CDA in Teaching Schedules
- School timetables should allow short diagnostic assessment periods within lessons.
 - Administrators should consider workload adjustments to accommodate CDA preparation and analysis.
7. Monitor and Evaluate CDA Implementation
- Schools should collect regular feedback from teachers on CDA practices and use it to improve training and resource allocation.

- Pilot programs in multiple districts could be used to refine CDA integration before nationwide scaling.

6.5 Limitations

The study was limited to eight teachers from only two districts (Botha-Bothe and Maseru), restricting the generalisability of the findings. CDA is still emerging in Lesotho, and participants had only 12 weeks of training before the study, which may have shaped their implementation experiences.

6.6 Future Directions

Future research could expand the geographic scope to all ten districts, include more diverse teacher profiles, and integrate learner perspectives. Studies employing longitudinal designs could explore the sustained impact of CDA on learner performance and teaching practices. Alternative data generation methods, such as learner performance analytics and teacher reflective journals could provide richer insights into CDA implementation. Quantitative study could also be recommended using the same districts and population.

References

- Abidin, I., Patah, M., Majid, M., & Usman, S. (2024). A Practical Guide to Improve Trustworthiness of Qualitative Research for Novices. *Asian Journal of Research in Education and Social Sciences*. <https://doi.org/10.55057/ajress.2024.6.s1.2>
- Ahmed, S. K. (2024). The Pillars of Trustworthiness in Qualitative Research. *Journal of Medicine, Surgery, and Public Health*, 2(1), 1–4. Science Direct. <https://doi.org/10.1016/j.glmedi.2024.100051>
- Akyeampong, K. (2017). Teacher Educators' practice and vision of good teaching in teacher education reform context in Ghana. *Sage Journals*.
- Alharahsheh, H. H., & Pius, A. (2020, December). A Review of key paradigms: positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences*. <https://www.researchgate.net/publication/338244145>
- Alieto ,E. (2019). Cognition as per predictor of willingness to teach in the mother tongue and as the subject. *ResearchGate*, 31(1), 135–139. <https://www.researchgate.net/publication/333994955>
- Andrade, C. (2021). The Inconvenient truth about convenience and purposive samples,. *Indian Journal of Psychological Medicine*, 43 (1), 86–88.
- Anisah,G. (2025). Is the student with the highest score considered the smartest? Making individualized evaluative decisions based on digital cognitive diagnostic assessment in reading. *Proceeding al Ghazali International Conference*, 2, 319–329. <https://doi.org/10.52802/aicp.v1i1.1277>
- Ayanwale, M, Chere-Masopha, J., Mochekele, M, & Morena, M. C. (2024). Implementing Computer Adaptive Testing for High-Stakes Assessment: A Shift for Examinations Council of Lesotho. *International Journal of New Education*, 14. <https://doi.org/10.24310/ijne.14.2024.20487>

- Baker, S. E., & Edwards, R. (2012). How many qualitative interviews is enough? *National Centre for Research Methods*.
- Bello, H., & Abdullah, N. (2020). Identifying factors of user satisfaction with summative E-Assessment; A qualitative approach. *Journal of Theoretical and Applied Information Technology*, 98.
- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation? *Qualitative Health Research*, 26(13), 1802–1811. <https://doi.org/10.1177/1049732316654870>
- Black, P., & William, D. (2009). Developing the theory of Formative Assessment. *Educational Assessment, Evaluation and Accountability*, 21 (1), 5–31.
- Braun, V., & Clarke, V. (2006, January). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*. <https://doi.org/10.1191/1478088706qp063oa>
- Braun, V., & Clarke, V. (2010). Thematic analysis; A practical guide; Sage.
- Brinkmann, S., & Kvale, S. (2015). Interviews; Learning the craft of Qualitative Research interviewing. 3rd edn. London; Sage.
- Brinkmann, S. & Kvale, S. (2015) *Interviews: Learning the Craft of Qualitative Research Interviewing*. 3rd edn. London: Sage.
- Brinson, & Steiner, L. (2007) Building collective self-efficacy with inquiry-based learning; A case study [Doctoral dissertation] North Central University. La Jolla, CA.
- Brookhart, S. M. (2013). How to create and use rubrics for formative assessment and grading. Alexandria, VA; ASCD.
- Brown, G. T. L. (2022). The past, present and future of educational assessment: A transdisciplinary perspective. *Frontiers in Education*, 7(1). <https://doi.org/10.3389/educ.2022.1060633>
- CAP. (2009). Curriculum and Assessment policy. MOET
- Chere-Masopha, J. (2022). A Survey of Teachers' Perceptions of a Learning Portfolio in Lesotho Classrooms. *International Journal of Learning, Teaching and Educational Research*, 21(6), 194–209. <https://doi.org/10.26803/ijlter.21.6.12>
- Chere-Masopha, J., & Mothetsi-Mothiba, L. (2022). Teachers' experiences of using a portfolio for teaching, learning, and assessment in Lesotho primary schools. *Cogent Education*, 9(1). <https://doi.org/10.1080/2331186x.2021.2023969>

- Chew, C. & Chin, H. (2024). *Online Cognitive Diagnostic Assessment with Ordered Multiple-Choice Items for Grade Four Topic of Time*.
https://doi.org/10.1142/9789811287183_0008
- Chin, H., & Chew, C. M. (2022a). Cognitive diagnostic assessment with ordered multiple-choice items for word problems involving “Time.” *Current Psychology*.
<https://doi.org/10.1007/s12144-022-02965-8>
- Chin, H., & Chew, C. M. (2022b). Online Cognitive Diagnostic Assessment with Ordered Multiple-Choice Items for Word Problems involving “Time.” *Education and Information Technologies*. <https://doi.org/10.1007/s10639-022-10956-2>
- Chin, H., Chew, C. M., & Lim, H. L. (2021). Development and validation of online cognitive diagnostic assessment with ordered multiple-choice items for “Multiplication of Time.” *Journal of Computers in Education*, 8(2), 289–316. <https://doi.org/10.1007/s40692-020-00180-7>
- Chin, H., Chew, C. M., Lim, H. L., & Thien, L. M. (2021). Development and Validation of a Cognitive Diagnostic Assessment with Ordered Multiple-Choice Items for Addition of Time. *International Journal of Science and Mathematics Education*, 20(4), 817–837.
<https://doi.org/10.1007/s10763-021-10170-5>
- Clark, A. K., Nash, B., & Karvonen, M. (2022). Teacher Assessment Literacy: Implications for Diagnostic Assessment Systems. *Applied Measurement in Education*, 35(1), 1–16.
<https://doi.org/10.1080/08957347.2022.2034823>
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry and Research Design; Choosing Among Five Approaches*. 4th edn. London; Sage.
- Culpepper, S., Fellouris, G., Sangbeak, Y., & Douglas, J. (2016). Sequential detection of learning in cognitive diagnosis. *British Journal of Mathematical and Statistical Psychology*, 69(2), 139–158. <https://doi.org/10.1111/bmsp.12065>
- Dahlberg, K., & Nystrom, M. (2008). *Reflective lifeworld Research*. 2nd edn. *Lundi; Studentlitteratur* .
- Dai, S., & Svetina Valdivia, D. (2022). Dealing with Missing Responses in Cognitive Diagnostic Modeling. *Psych*, 4(2), 318–342. <https://doi.org/10.3390/psych4020028>
- De Andrade, S., Schmitt, M., Storck, B., Piccoli, T., & Ruoff, A. (2018). Analise documental nas teses de enfermagem; Técnica de coleta de dados e método de pesquisa. *Cogitare*

- Enfermagem*, 23(1). <https://doi.org/10.5380/ce.v23i1.53598>
- Dewi, N.L.G. (2024). Strategi Efektif untuk Mengembangkan Instrumen Asesmen Kognitif dalam Pembelajaran Bahasa Indonesia. *Jurnal Motivasi Pendidikan Dan Bahasa*, 2(3), 141–150. <https://doi.org/10.59581/jmpb-widyakarya.v2i3.3864>
- Ekayati, R., & Meisuri, M. (2023). Analysis of Cognitive Diagnostic Assessment (CDA) in Differentiated Learning on English Subject Phase D. *Randwick International of Education and Linguistics Science Journal*, 4(4), 1063–1073. <https://doi.org/10.47175/rielsj.v4i4.841>
- Fan, T., Song, J., & Guan, Z. (2021). Integrating diagnostic assessment into curriculum: a theoretical framework and teaching practices. *Language Testing in Asia*, 11(1). <https://doi.org/10.1186/s40468-020-00117-y>
- Fan, T., & Yan, X. (2020). Diagnosing English reading ability in Chinese senior high schools. *Studies in Educational Evaluation*, 67, 100931. <https://doi.org/10.1016/j.stueduc.2020.100931>
- Finlay, L. (2008) 'A dance between the reduction and reflexivity: explicating the "phenomenological psychological attitude"', *Journal of Phenomenological Psychology*, 39(1), pp. 1-32.
- Finlay, L. (2021) *Practising Existential Therapy: The Relational World*. 2nd edn. London: Sage.
- Furtado, R. (2010) Learning principles, fundamental processes, theories and models. *Sao Paulo; Southern cross*
- Gao, X., Hou, M., Wang, F., & Zhou, J. (2025). A new person-fit statistic for the detection of aberrant responses in polytomous cognitive diagnostic models. *Behavior Research Methods*, 57(5). <https://doi.org/10.3758/s13428-025-02659-6>
- Gaspar, A. S. (2023). Differential effects of mother tongue and English Language as a medium of instruction on pupil's numeracy skills. *Deleted Journal*, 1(2), 77–118. <https://doi.org/10.59762/rer904105361220231220142944>
- Giorgi, A. (2009) The Descriptive Phenomenological Method in Psychology: A Modified Husserlian Approach. Pittsburgh: *Duquesne University Press*.
- Haghighayeghi, M., Moghadamzadeh, A., Ravand, H., Javadipour, M., & Kareshki, H. (2024). Development of a cognitive assessment checklist for first-grade Mathematics: utilizing

- hierarchical cognitive diagnostic modeling in elementary education. *Journal of Psychoeducational Assessment*. <https://doi.org/10.1177/07342829241290277>
- Hasibuan, H. Y., Ruhiat, Y., & Santosa, C. A. H. F. (2024). Designing a cognitive diagnostic test for Mathematics; a needs analysis . *Proceeding of International Conference on Education and Sharia*, 1, 389–397. <https://doi.org/10.62097/ices.v124.68>
- Hasyim, F, Nurjati,N, & Rahayu, E. (2025). Exploring the washback effect of summative assessment on junior high schools EFL students: insight from teachers’ perspectives. *EduInovasi Journal of Basic Educational Studies*, 5(2), 781–796. <https://doi.org/10.47467/edu.v5i2.7425>
- Heidegger, M. (1962). Being and time. Translated by MacQuarrie & E.Robinson. *New York;Harper & Row*.
- He, L., Jiang, Z., & Min, S. (2021). Diagnosing writing ability using China’s Standards of English Language Ability: Application of cognitive diagnosis models. *Assessing Writing*, 50, 100565. <https://doi.org/10.1016/j.asw.2021.100565>
- He, L., Xiong, L., & Min, S. (2022). Diagnosing listening and reading skills in the Chinese EFL context: Performance stability and variability across modalities and performance levels. *System*, 106, 102787. <https://doi.org/10.1016/j.system.2022.102787>
- Hermawan,H.A. (2025). Junior high school teacher challenges, practices and strategies on implementing differentiated instruction in EFL classroom. *Pupil International Journal of Teaching Education and Learning*, 233–234. <https://doi.org/10.20319/ictel.2024.233234>
- Huang, R., Liu, Z., Zi, D., Huang, Q., & Pan, S. (2022). A multi-level remedial teaching design Based on Cognitive Diagnostic Assessment: Taking the electromagnetic induction as an Example. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.851378>
- Husserl, E. (1970). The crisis of European Sciences and Transcendental phenomenology. Translated by D.Carr.Evanston; *North-Western University Press* .
- Husserl, E. (1982). Ideas pertaining to pure phenomenology and to a phenomenological philosophy; first book. Translated by F.Kersten. *The Hague; Martinus Nijhoff*.
- Ibraimova, A. (2017). Running head: Implementation of the Integrated Curriculum in Kazakhstani Secondary Schools: Challenges and Opportunities in pilot schools at School Level. https://nur.nu.edu.kz/bitstream/handle/123456789/2561/Assemgul_Ibraimova..pdf?isAll

- Jang, E. E. (2008, January 1). *A framework for cognitive diagnostic assessment*.
https://www.researchgate.net/publication/257428786_A_framework_for_cognitive_diagnostic_assessment
- Junpeng, P., Marwiani, M., Chinjunthuk, S., Suwannatrain, P., Chanayota, K., Pongboriboon, K., Tang, K. N., & Wilson, M. (2020). Validation of a digital tool for diagnosing mathematical proficiency. *International Journal of Evaluation and Research in Education (IJERE)*, 9(3), 665. <https://doi.org/10.11591/ijere.v9i3.20503>
- Kakar, Z., Rasheed, R., Rashid, A., & Akhter, S. (2023). Criteria for assessing and ensuring the trustworthiness in qualitative research. *International Journal of Business Reflections*, 4(2), 150–173. <https://doi.org/10.56249/ijbr.03.01.44>
- Kamal, S. S. L. B. A. (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>
- Karmila, R., & Handayani, D.F. (2024). Konsep Asesmen Ranah Kognitif dalam Pendidikan. *CENDEKIA: Jurnal Ilmu Sosial, Bahasa Dan Pendidikan*, 4(3), 177–188.
<https://doi.org/10.55606/cendekia.v4i3.3060>
- Khatri, K. K. (2020). Research paradigm: A philosophy of educational research. *International Journal of English Literature and Social Sciences*, 5(5), 1435–1440.
<https://dx.doi.org/10.22161/ijels.55.15>
- Khumalo, M. (2025). Enhancing digital literacy for learners in Inclusive Primary and Secondary Education in Lesotho. *European Journal of Education and Pedagogy*, 6(2), 12–21.
<https://doi.org/10.24018/ejedu.2025.6.2.928>
- Kocaman, R. (2024). A Practical Guideline for Addressing Data Trustworthiness in Qualitative Research. *Advances in Library and Information Science (ALIS) Book Series*, 317–346.
<https://doi.org/10.4018/979-8-3693-3069-2.ch011>
- Kim, R. Y., & Yoo, Y. J. (2024). Multistage testing for cognitive diagnosis based on skill-space partitioning. *Authorea Preprints*.
<https://doi.org/10.31124/advance.171272698.83636340/v1>
- King, N. & Horrocks, C. (2010) *Interviews in Qualitative Research*. London: Sage.
- Kolobe, M. A., & Matsoso, L. (2020). Effects of Language Status on Assessment and Educational Development of Basotho Learners from Minority Languages' Backgrounds.

- International Journal of Language Education*, 4(3).
<https://doi.org/10.26858/ijole.v4i3.14046>
- Koloti, A. C., & Jita, T. (2021). Grade R teachers' experiences with the implementation of the mother-tongue-instruction policy for pre-reading skills in Lesotho. *South African Journal of Childhood Education*, 11(1). <https://doi.org/10.4102/sajce.v11i1.957>
- Kometsi, L. (2024). Legal protection of minority languages in Lesotho : the case of siPhuthi language of ebaPhuthi | Lesotho Law Journal. *Lesotho Law Journal*.
<https://doi.org/10.10520/EJC177121>
- Kurata, L., Selialia, M., Molefi, R., & Rateronko, S. (2024). Integrating educational technology into Lesotho Secondary Religious Studies: A conceptual exploration of practical challenges and opportunities. *International Journal of Science and Research Archive*, 13(1), 2838–2847. <https://doi.org/10.30574/ijrsra.2024.13.1.1933>
- Kyong, C., Young-Sun, L., & Yoon, P. (2015). What CDM Can Tell About What Students Have Learned: An Analysis of TIMSS Eighth Grade Mathematics. *EURASIA Journal of Mathematics, Science & Technology Education*, 11(6).
<https://doi.org/10.12973/eurasia.2015.1421a>
- Leballo, M., Griffiths, D., & Bekker, T. (2021). Differentiation practices in a private and government high school classroom in Lesotho: Evaluating teacher responses. *South African Journal of Education*, 41(1), 1–13. <https://doi.org/10.15700/saje.v41n1a1835>
- LBCEP. (2021). *Lesotho Basic Education Curriculum Policy* . Ministry of Education Lesotho.
- Lee, Y.-W. (2015). Future of diagnostic language assessment. *Language Testing*, 32(3), 295–298. <https://doi.org/10.1177/0265532214565385>
- Leighton, J. P. (2022). *Cognitive Diagnostic Testing*. <https://doi.org/10.4324/9781138609877-ree198-1>
- Lekhetho, M. (2022). Exploring factors influencing the performance of high-achieving secondary schools in Lesotho. *Issues in Educational Research*, 31(3), 871–890.
<https://www.researchgate.net/publication/358147615>
- Letseka, M. (2022). Ethics and African philosophy of education. African ethics. *A Guide to Key Ideas*.
- Leung, H ., Fung, T., & Chang, L. (2025) Understanding self-rated health -examining the mediating effect of self-efficacy . *ResearchGate*

- Li, C. (2022). Development and application of assessment tools based on cognitive diagnosis. *IEEE Access*, 13, 47165–47180. <https://doi.org/10.1109/icise-ie58127.2022.00028>
- Li, L., Yi, A., Jie, R., & Xiaoman, W. (2021). Research on the cognitive diagnosis of Chinese listening comprehension ability based on the G-DINA model. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2021.714568>
- Li, Y., Zhen, M., & Liu, J. (2021). Validating a reading assessment within the cognitive diagnostic assessment framework: Q-Matrix Construction and Model Comparisons for Different Primary Grades. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.786612>
- Lian, J. (2024). An analysis of inequality in educational resources in the United States. *Advances in economics management and political sciences*, 127(1), 163–169. <https://doi.org/10.54254/2754-1169/2024.OX18534>
- Liu, M., Hashim, H., & Sulaiman, N. (2025). Cognitive diagnostic assessment for IELTS speaking skills; A Chinese high school. <https://dx.doi.org/10.24093/awej/vol16no2.16>
- Makatjane, T. J. (2023). Assessment reforms in primary education: Challenges and Opportunities; *African Educational Journal*, 45–59.
- Makau, C. (2023). Teachers' perceptions of learner transition assessment portfolio in selected schools in two Lesotho Districts. *Tml.nul.ls*. <https://hdl.handle.net/20.500.14155/1919>
- Makoa, M., & Moea, K. (2025). Translanguaging and social justice: The stance of the minority languages through the lens of the Lesotho curriculum policy. *E-Journal of Humanities, Arts and Social Sciences*, 1042–1051. <https://doi.org/10.38159/ehass.2025678>
- Mandillah, L. (2019). Kenyan curriculum reforms and mother tongue education; issues, challenges and implementation strategies. *SCIELO South Africa*, 23.
- Mei, H., & Chen, H. (2022). Assessing students' translation competence: Integrating China's Standards of English with cognitive diagnostic assessment approaches. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.872025>
- Merleau-Ponty, M. (2012). *Phenomenology of perception*. Translated by D.A Landes; London; Routledge.
- Min, S., & He, L. (2021). Developing individualized feedback for listening assessment: Combining standard setting and cognitive diagnostic assessment approaches. *Language Testing*, 026553222199547. <https://doi.org/10.1177/0265532221995475>

- MOET. (2016). *Education Sector plan 2016-2026*.
- Moea, K (2022) Problems faced by Lesotho piloting high school in implementing the 2009 Curriculum and Assessment Policy. *Merit research journals*
- Mofana ,M, & Nkhi,S. (2024). Investigating the challenges faced by students in online learning implementation post COVID-19 in three selected tertiary institutions in Lesotho. *ResearchGate*, 1(1), 149–171. <https://doi.org/10.31920/2753-3166/2024/v1n1a8>
- Moloi, K. (2019). Learners and educators as agents of social transformation in dysfunctional South African schools. *ResearchGate*.
- Monarrez, A., & Tchoshanov, M. (2020). Unpacking teacher challenges in understanding and implementing cognitively demanding tasks in secondary school mathematics classrooms. *International Journal of Mathematical Education in Science and Technology*, 1–20. <https://doi.org/10.1080/0020739x.2020.1857860>
- Muhamad, Mohd, Sulaiman, N. A., Mohd Tarmizi Azeman, Ishak, H., Othman, N., Nurbaya Mohd Rosli, & Siti Hannah Sabtu. (2024). Cognitive diagnostic assessment in educational testing: A score strategy-based evaluation. *Deleted Journal*, 20(4). <https://doi.org/10.17576/ebangi.2024.2104.21>
- Mukurunge, T., Tlali, N, & Bhila. T. (2019, July 9). Free education at primary school level, benefits and challenges; Case of Lesotho after 2010. <https://www.researchgate.net/publication/334319729>
- Nájera, P., Abad, F., Chiu, C.-Y., & Sorrel, M. A. (2023). The restricted DINA model: A comprehensive cognitive diagnostic model for classroom-level assessments. *Journal of Educational and Behavioral Statistics*, <https://doi.org/10.3102/10769986231158829>
- Nishanthi, R. (2020, November). Understanding of the importance of mother tongue learning. *ResearchGate*. <https://www.researchgate.net/publication/345436020>
- Niure, D., & Sapkota, M. (2025). Philosophical assumptions across paradigms: Implications for educational research. *ILAM ५१११*, 21(1), 36–46. <https://doi.org/10.3126/ilam.v21i1.75654>
- Ntereke, N., & Mphunyane, M. (2025). Perceptions of secondary school mathematics teachers and the challenges faced in implementing grade 9 curriculum: A case of two schools in Lesotho. *Journal of Mathematics and Science Teacher*, 5(2), em080. <https://doi.org/10.29333/mathsciteacher/16060>
- Olabiyi,O. (2024, May 11). *Understanding the Fundamentals of Research Paradigms:*

Interpretivism, Positivism, and Mixed Methods.

<https://doi.org/10.13140/RG.2.2.20281.79205>

- Olofin, T., Bukola, A., Arogundade, B., Babatope, & Abisola, J. (2025). RESOURCES ALLOCATION IN EDUCATION. *Researchgate*, 19(1), 102–110.
https://www.researchgate.net/publication/391987852_RESOURCES_ALLOCATION_IN_EDUCATION
- Owoseni, A., Kolade, O., & Egbetokun, A. (2024). *Applications of Generative AI in Summative Assessment*. 97–122. https://doi.org/10.1007/978-3-031-60179-8_4
- Padauleng, A., Abduh, A., Samtidar, S., Muslim, A., Mujizatullah, M., Massoweang, A. K., Ridwan, M., Darmawati, B., & Rosidi, A. (2025). Differentiated Instruction in a Public Junior High School: EFL Teachers' Perception and Practices. *World Journal of English Language*, 15(3), 277–277. <https://doi.org/10.5430/wjel.v15n3p277>
- Padilla, G., Guerra, F., & Zamora, R. (2019). Effective school practices in Title I Schools Exceeding Educational Expectations (E3). *International Journal of Educational Reform*, 29(2), 103–122. <https://doi.org/10.1177/1056787919886582>
- Panahi, A., & Mohebbi, H. (2022). Cognitive diagnostic assessment of IELTS Listening: providing feedback from its Internal structure. *Language Teaching Research Quarterly*, 29, 147–160. <https://doi.org/10.32038/ltrq.2022.29.10>
- Paulsen, J., & Valdivia, D. S. (2021). Examining cognitive diagnostic modeling in classroom assessment conditions. *The Journal of Experimental Education*, 1–18.
<https://doi.org/10.1080/00220973.2021.1891008>
- Phongsirikul, M. (2018). Traditional and alternative assessments in ELT: students' and teachers' perceptions. *Reflections*, 25(1), 61–84. <https://doi.org/10.61508/refl.v25i1.136267>
- Phosisi, Itumeleng Juliet. (2019). Integrated curriculum in Lesotho: challenges encountered by learners through their teachers' views. *Ukzn.ac.za*.
<https://researchspace.ukzn.ac.za/handle/10413/20088>
- Polkinghorne, D. E. (1989). Phenomenological research methods, in Valle, R. S. & S. (eds) *existential-phenomenological perspectives in Psychology*. Boston; Springer, 41–60.
- Pretorius, L. (2024). Demystifying research paradigms: Navigating ontology, epistemology, and axiology in research. *The Qualitative Report*, 29(10), 2698–2715.
<https://doi.org/10.46743/2160-3715/2024.7632>

- Pring, R. (2015). *Philosophy of Educational Research*. 3rd edition. London; Bloomsbury
- Quansah, F. (2018). (PDF) Traditional or Performance Assessment: What is the Right Way to Assessing Learners? *ResearchGate*.
<https://www.researchgate.net/publication/323760543>
- Rakolobe, K. A., & Teise, K. L. G. (2024). Contextual factors obstructing the effective implementation of the curriculum and assessment policy in the Lesotho education sector. *Research in Educational Policy and Management*, 6(1), 52–71.
<https://doi.org/10.46303/repam.2024.4>
- Ravand, H., & Robitzsch, A. (2018). Cognitive diagnostic model of best choice: a study of reading comprehension. *Educational Psychology*, 38(10), 1255–1277.
<https://doi.org/10.1080/01443410.2018.1489524>
- Reinita, & Syahroh, K. (2024). Quizizz-assisted cognitive diagnostic assessment in Pancasila education learning in elementary schools. *Jurnal Imiah Pendidikan Dan Pembelajaran*, 8(3), 547–556. <https://doi.org/10.23887/jipp.v8i3.83527>
- Ridge, B. L., & Lavigne, A. L. (2020). Improving instructional practice through peer observation and feedback: A review of the literature. *Education Policy Analysis Archives*, 28(61), 61.
<https://doi.org/10.14507/epaa.28.5023>
- Romlah R., Undang R., & Pramudiyanti P. (2025). Development of Cognitive and Non-Cognitive Diagnostic Assessment Instruments in Differentiation Learning For Class IV Primary School. *Journal of Innovation and Research in Primary Education*, 4(2), 281–291. <https://doi.org/10.56916/jirpe.v4i2.1231>
- Rupp, A. S., Templin, J., & Henson, R. A. (2010). *Diagnostic measurement; Theory, methods and application*. New York; Guilford Press.
- Ruzvidzo, J. (2022). Minority-language education in Zimbabwe: A human rights-based approach to achieving SDG4. *ResearchGate*. <https://doi.org/10.13140/RG.2.2.21948.92803>
- Sanders, P. (2003). Phenomenology; A new way of viewing organisational research. 3rd edition. *Academy of Management Review*;, 8 (3), 353–360.
- Sandholm, D., Simonsen, J., Ström, K., & Fagerlund, Å. (2022). Teachers' experiences with positive education. *Cambridge Journal of Education*, 53(2), 1–19.
<https://doi.org/10.1080/0305764x.2022.2093839>
- Saso, S., Oka, M., & Uesaka, Y. (2023). Diagnosing the depth of understanding using cognitive

- diagnostic models and their application to regular test;Examining the applicability of cognitive diagnostic models with Q-Matrix specified through qualitative and quantitative procedures . *Japanese Cognitive Science Society*. <https://doi.org/10.11225/cs.2023.057>
- Seipel, B., Biancarosa, G., Carlson, S. E., & Davison, M. L. (2018). The need, use, and future of cognitive diagnostic assessments in classroom practice. *Handbook of Research on Program Development and Assessment Methodologies in K-20 Education*, 1–23. <https://doi.org/10.4018/978-1-5225-3132-6.ch001>
- Seidman, I. (2019) *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences*. 5th edn. New York: *Teachers College Press*.
- Sen, S., & Cohen, A. S. (2021). Sample size requirements for applying diagnostic classification models. *Frontiers in Psychology*, *11*. <https://doi.org/10.3389/fpsyg.2020.621251>
- Sessoms, J., & Henson, R. A. (2018). Applications of diagnostic classification models: A literature review and critical commentary. *Measurement: Interdisciplinary Research and Perspectives*, *16*(1), 1–17. <https://doi.org/10.1080/15366367.2018.1435104>
- Shulman, L.S. (1987) 'Knowledge and teaching: Foundations of the new reform', *Harvard Educational Review*, *57*(1), pp. 1-23.
- Smith, J.A. (2017) *Interpretative Phenomenological Analysis: Theory, Method and Research*. London: *Sage*.
- Smith, J.A., Flowers, P. & Larkin, M. (2022) *Interpretative phenomenological analysis: Theory, method and research*. 2nd edn. London: *Sage*.
- Shahsavari, Z. (2019). Diagnosing English learners' writing skills: A cognitive diagnostic modeling Study. *Cogent Education*, *6*(1). <https://doi.org/10.1080/2331186X.2019.1608007>
- Shi, X., Ma, X., Du, W., & Gao, X. (2023). Diagnosing Chinese EFL learners' writing ability using polytomous cognitive diagnostic models. *Language Testing*, 02655322211628-026553222311628. <https://doi.org/10.1177/02655322231162840>
- Shikalepo, E. (2020). Challenges facing learning at rural schools: A review of related literature. *ResearchGate*, *4*(3), 2454–6186. <https://www.researchgate.net/publication/340272978>
- Sholihah, L., & Miranty, D. (2025). Gamified diagnostic assessment using quizizz: Investigating motivation and perceptions of Indonesian ESL students. *Jo-ELT (Journal of English Language Teaching) Fakultas Pendidikan Bahasa & Seni Prodi Pendidikan Bahasa*

- Inggris IKIP*, 12(1), 176–176. <https://doi.org/10.33394/jo-elt.v12i1.15153>
- Sia, C. J. L., & Lim, C. S. (2018). Cognitive diagnostic assessment: An alternative mode of assessment for learning. *ICME-13 Monographs*, 123–137. https://doi.org/10.1007/978-3-319-73748-5_9
- Silvia, A., Quraisy, S., Maimun, Inayati, M., & Arifin, M.S (2024). Diagnostic assessment on the independent learning curriculum in Pai learning *Intiha.*, 2(1), 191–201. <https://doi.org/10.58988/intiha.v2i1.323>
- Subheesh, N. P., & Sethy, S. S. (2020). Learning through assessment and feedback practices: A critical review of engineering education settings. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(3), em1829. <https://doi.org/10.29333/ejmste/114157>
- Sujinah, Isnah, E, Muslim, F., & M. Kharis. (2024). Utilizing cognitive diagnostic assessments to identify and address student needs in differentiated classrooms. *Journal of Higher Education Theory and Practice*, 24(1). <https://doi.org/10.33423/jhetp.v24i1.6763>
- Sun, H., & Kang, Y. (2022). A review of cognitive diagnosis assessment in language from 2000 to 2021: A visualized analysis with cite space II. *Journal of Humanities and Social Sciences Studies*, 4(3), 182–191. <https://doi.org/10.32996/jhsss.2022.4.3.17>
- Taatgen, N. A., van Vugt, M. K., Borst, J. P., & Mehlhorn, K. (2016). Cognitive modeling at ICCM: State of the art and future directions. *Topics in Cognitive Science*, 8(1), 259–263. <https://doi.org/10.1111/tops.12185>
- Tang, F., & Zhan, P. (2020). The development of an instrument for longitudinal learning diagnosis of rational number operations based on parallel tests. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.02246>
- Tang, F., & Zhan, P. (2021). Does diagnostic feedback promote learning? Evidence from a longitudinal cognitive diagnostic assessment. *AERA Open*, 7(1), 233285842110608. <https://doi.org/10.1177/23328584211060804>
- Tariq, M. (2025, April 24). Ensuring trustworthiness and rigor in qualitative research. *ResearchGate*. <https://doi.org/10.4018/979-8-3693-7200-5.ch012>
- Tochhawng, D. L. (2024). Educational inequality and social justice: Analyzing barriers to access in marginalized communities. *African Journal of Biomedical Research*, 655–662. <https://doi.org/10.53555/ajbr.v27i3s.2086>

- Toprak-Yildiz, T. E. (2021). An international comparison using cognitive diagnostic assessment: Fourth graders' diagnostic profile of reading skills on PIRLS 2016. *Studies in Educational Evaluation*, 70, 101057. <https://doi.org/10.1016/j.stueduc.2021.101057>
- Wang, F., Liu, Q., Chen, E., Liu, C., Huang, Z., Wu, J., & Wang, S. (2024). Unified uncertainty estimation for cognitive diagnosis models. *Proceedings of the ACM Web Conference 2022*, 3545–3554. <https://doi.org/10.1145/3589334.3645488>
- Wiyaka ., Silitonga L.M., Sunardi S., & Tyas, Y. (2025). Leveraging diagnostic assessment aligned to differentiated learning: Voices of English Language teachers. *KnE Social Sciences*, 10(9), 175–188. <https://doi.org/10.18502/kss.v10i9.18486>
- world bank . (2021). *The world bank annual report 2021*.
- Wu, H.-M. (2018). Online individualised tutor for improving mathematics learning: a cognitive diagnostic model approach. *Educational Psychology*, 39(10), 1218–1232. <https://doi.org/10.1080/01443410.2018.1494819>
- Wu, L.-J. (2024). Using AI cognitive diagnosis embedded in a game-based learning environment. *2024 IEEE International Conference on Big Data (BigData)*, 8173–8178. <https://doi.org/10.1109/bigdata62323.2024.10825060>
- Wu, X., Xu, T., & Wu, R. (2024). Research on personalized assessment Information of students' mathematical competency based on cognitive diagnosis. *Thinking Skills and Creativity*, 53, 101596. <https://doi.org/10.1016/j.tsc.2024.101596>
- Xiong, J., Luo, Z., Luo, G., & Yu, X. (2022). Data-driven Q-matrix learning based on Boolean matrix factorization in cognitive diagnostic assessment. *British Journal of Mathematical and Statistical Psychology*, 75(3), 638–667. <https://doi.org/10.1111/bmsp.12271>
- Yambi, T. de A. C. (2020). Assessment and evaluation in education. *ResearchGate*. <https://www.researchgate.net/publication/342918149>
- Yigit ,H, & Culpepper, S. (2023). Extending exploratory diagnostic classification models: Inferring the effect of covariates. *British Journal of Mathematical & Statistical Psychology/British Journal of Mathematical and Statistical Psychology*, 76(2), 372–401. <https://doi.org/10.1111/bmsp.12298>
- Zhang, Y., Zhao, B., Jian, M., & Wu, X. (2025). Cognitive diagnostic analysis of mathematics key competencies based on PISA data. *PLoS ONE*, 20(2), e0315539–e0315539. <https://doi.org/10.1371/journal.pone.0315539>

- Zhang, Z. (2018). Designing Cognitively Diagnostic Assessment for Algebraic Content Knowledge and Thinking Skills. *International Education Studies*, 11(2), 106. <https://doi.org/10.5539/ies.v11n2p106>
- Zickafoose, A., Ilesanmi, O., Diaz-Manrique, M., Adeyemi, A. E., Walumbe, B., Strong, R., Wingenbach, G., Rodriguez, M. T., & Dooley, K. (2024). Barriers and Challenges Affecting Quality Education (Sustainable Development Goal #4) in Sub-Saharan Africa by 2030. *Sustainability*, 16(7), 2657. <https://doi.org/10.3390/su16072657>

APPENDIX 1; INTERVIEW GUIDE

Research questions and semi-structure interviews attached.

Research question 1; What are the experiences of practicing teachers regarding the implementation and use of CDA in their classrooms?

- *Can you describe your experience with implementing CDA into your teaching practices?
- *What motivated you to incorporate CDA into your teaching practices?
- *Can you walk me through a specific instance where you used CDA to assess student learning?
- *What challenges, if any, did you encounter while implementing CDA in your classroom?
- *How do you perceive the impact of CDA on your teaching practices and student learning outcomes?
- *What strategies have you found effective in integrating CDA into your instructional planning?

Question 2; How do practicing teachers perceive the effectiveness and utility of CDA in improving their assessment practices and supporting student learning in Lesotho?

- *How do you perceive the effectiveness of CDA compared to traditional assessment methods?
- * In what ways do you believe CDA enhances your assessment practices?

*Can you provide examples of how CDA has helped you identify specific areas of student strengths and weaknesses?

*How do you think CDA contributes to promoting deeper student understanding of concepts?

*What benefits do you see in using CDA for informing your instructional decisions and interventions?

*Have you observed any challenges or limitations in using CDA to support student learning outcomes?

QUESTION 3a) What are the main challenges faced by practicing teachers in Lesotho classrooms when integrating CDA into their classrooms?

*What are the primary challenges you face when integrating CDA into your teaching practices?

*How do you navigate resource constraints or other logical challenges associated with implementing CDA?

*Have you encountered any resistance or skepticism from colleagues or administrators regarding the use of CDA?

QUESTION 3b) What strategies do they employ to address these challenges?

*What strategies have you found effective in overcoming challenges related to implementing CDA?

*How do you ensure that CDA aligns with the curriculum and learning objectives in your classroom?

*In what ways do you collaborate with other teachers or educational stakeholders to support the effective implementation of CDA?

APPENDIX 2; CODE REPORT

Code

Alignment with Curriculum and Formative Assessment Principles
Collaborative Support and Resource Optimization
Continuous, Embedded Assessment Aligned with Learning Objectives
Deeper Diagnostic Insight and Individualized Learning Support
Designing CDA Tasks Based on Curriculum Learning Outcomes
Desire to Understand and Address Individual Learning Needs
Diagnostic Insight and Tailored Intervention
Enhanced Awareness of Learners' Strengths and Gaps
Enhanced Instructional Planning and Responsiveness to Learners' Needs
Enhanced Questioning and Depth in Assessment Strategies
Enhancing Critical Thinking and Conceptual Engagement
Flexible Planning and Creative Workarounds
Identifying Conceptual Misunderstandings and Weaknesses
Improved Engagement and Learner Empowerment
Improved Student Engagement, Motivation, and Academic Outcomes
Inadequate Resources and Training
Individualized Instruction and Learner-Centered Adaptation
Informed and Individualized Instructional Planning
Informed Lesson Planning and Instructional Alignment
Insufficient Training and Limited Resources
Integrating CDA into Instructional Planning and Assessment Cycles
Learner Diversity and Large Class Sizes
Learner-Centered Grouping and Active Engagement Approaches
Leveraging Low-Tech and Readily Available Resources
Observed Challenges or Limitations in Using CDA to Support Student Learning Outcomes
Overcrowded Classrooms and High Learner Diversity
Peer Observation and Consultation for Professional Learning
Personalized Support and Instructional Adjustment for Learner Mastery
Positive Impact on Learner Engagement, Participation, and Mastery
Recognizing Learner Strengths and Skill Mastery
Regular Collaborative Meetings for Shared Reflection and Planning
Remedial and Extra Instructional Time
Resistance or Skepticism from Colleagues or Administrators Regarding the Use of CDA
Self-Directed Learning and Online Research
Strategic Learner Grouping for Efficient Remediation
Time and Workload Demands
Time Constraints and Teacher Workload
Timely, Formative Feedback for Improved Instruction and Learning Outcomes
Using CDA to Adjust Instruction and Support Learner Growth
Using CDA to Identify Specific Conceptual or Skill-Based Gaps in Subject Areas

Comment Code Group 1

Adaptive Strategies for Overcoming Challenges in Implementing CDA

Adaptive Strategies for Overcoming Challenges in Implementing CDA

Adaptive Strategies for Overcoming Challenges in Implementing CDA

Code Group 2

Aligning CDA with Curriculum and Instructional Objectives

Aligning CDA with Curriculum and Instructional Objectives

Code Group 3

Barriers to Effective Implementation of CDA in the Classroom

Barriers to Effective Implementation of CDA in the Classroom

Barriers to Effective Implementation of CDA in the Classroom

Barriers to Effective Implementation of CDA in the Classroom

Barriers to Effective Implementation of CDA in the Classroom

Barriers to Effective Implementation of CDA in the Classroom

Code Group 4

Benefits of CDA for Informed, Targeted, and Responsive Instruction

Benefits of CDA for Informed, Targeted, and Responsive Instruction

Benefits of CDA for Informed, Targeted, and Responsive Instruction

Code Group 5

CDA as a Catalyst for Deep Conceptual Understanding and Learner Growth

CDA as a Catalyst for Deep Conceptual Understanding and Learner Growth

Code Group 6

CDA as a Transformative Tool for Responsive and Informed Assessment Practices

CDA as a Transformative Tool for Responsive and Informed Assessment Practices

CDA as a Transformative Tool for Responsive and Informed Assessment Practices

CDA as a Transformative Tool for Responsive and Informed Assessment Practices

Code Group 7

Collaborative Practices to Enhance the Implementation of CDA

Collaborative Practices to Enhance the Implementation of CDA

Code Group 8

Effective Strategies for Integrating CDA into Instructional Planning

Effective Strategies for Integrating CDA into Instructional Planning

Code Group 9

Observed any Challenges or Limitations in Using CDA to Support Student Learning Outcomes

Code Group 10

Perception of CDA as a Superior Alternative to Traditional Assessment Methods

Positive Trends in Assessment and Learning through CDA

Positive Trends in Assessment and Learning through CDA

Perception of CDA as a Superior Alternative to Traditional Assessment Methods

Code Group 11

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Code Group 11

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Positive Transformations in Teaching and Learning through CDA

Code Group 12

Primary Challenges in Integrating CDA into Classroom Practice

Primary Challenges in Integrating CDA into Classroom Practice

Primary Challenges in Integrating CDA into Classroom Practice

Code Group 13

Resistance or Skepticism from Colleagues or Administrators Regarding the Use of CDA

Code Group 14

Specific Integration of CDA to Diagnose and Address Specific Learning Challenges
Specific Integration of CDA to Diagnose and Address Specific Learning Challenges

Code Group 15

Teachers' Adaptive Strategies for Navigating Resource and Logistical Constraints in Implementing C

Teachers' Adaptive Strategies for Navigating Resource and Logistical Constraints in Implementing C

Teachers' Adaptive Strategies for Navigating Resource and Logistical Constraints in Implementing C

Code Group 16

Teachers' Experiences with Implementing CDA in Classroom Practice

CDA

Teachers' Experiences with Implementing CDA in Classroom Practice

CDA

CDA

Code Group 17

Teachers' Motivations for Incorporating CDA into Their Teaching Practices

Teachers' Motivations for Incorporating CDA into Their Teaching Practices

Teachers' Motivations for Incorporating CDA into Their Teaching Practices

Code Group 18

Using CDA to Reveal Learner-Specific Cognitive Patterns and Instructional Needs

Using CDA to Reveal Learner-Specific Cognitive Patterns and Instructional Needs

The National University of Lesotho

Telephone: +266 22340601



P.O. Roma 180
Lesotho

Faculty of Education

29th October 2024.

RE: Letter of introduction

This letter introduces **Moipone Mokhethi (202103113)** as a student registered in the Faculty of Education for a master's degree programme. She is assigned work to collect information on a topic of interest to her study to blend her theory and practice. She will explain the topic of interest to you and will follow all ethical protocols to protect the institution and human participants in the study. She will share with you the following information, letter for participants detailing the objectives of the study and ethical protocols that would help you make informed consent.

I will be glad if she gets the support needed to complete her study programme.

Yours Sincerely

A handwritten signature in black ink, appearing to read 'Paseka A. Mosia'.

Paseka A. Mosia (D.Ed.)
Associate Professor of Inclusive Education
Dean, Faculty of Education
Cell: +26658969867
Email: mosia296@gmail.com / pa.mosia@nul.ls

APPENDIX ;4: LANGUAGE EDITING CERTIFICATE



A: CPUT, Education Campus, Room 2.45, Highbury Road, Mowbray, Cape Town, 7700

Global Institute for Teacher Education and Society (GITES)

EDITING CERTIFICATE

This is to certify that the manuscript titled: Exploring Practicing Teachers' Experiences In Using Cognitive Diagnostic Assessment In Their Classrooms

BY

MOIPONE MOKHETHI

202103113

has been thoroughly edited for language, grammar, structure, and coherence by **Dr. Tawanda Wallace Mataka**.

The editing process focused on ensuring clarity of ideas, correctness of grammar and punctuation, appropriate academic tone, and consistency in style and formatting.

Dr. Mataka holds extensive experience in academic editing and English Language Teaching, and the revisions made are aimed at enhancing the overall readability and scholarly quality of the manuscript.

Should you require any further information, please feel free to contact me at **0027713144978** or via email at **tawandamataka@gmail.com**.

Yours

sincerely,

Dr.

Tawanda

Wallace

Mataka

APPENDIX 5; SIMILARITY INDEX FROM TURNIT PLAGERISM CHECKER

Moipone Mokhethi 202103113 dissertation-final (1) EXAM.docx

Practice Assignment
Postgraduate Studies 2024_25
National University of Lesotho

Document Details

Submission ID
trn:oid::1:3334300418

Submission Date
Sep 9, 2025, 9:43 PM GMT+2

Download Date
Sep 10, 2025, 6:26 AM GMT+2

File Name
Moipone_Mokhethi_202103113_dissertation-final_1_EXAM.docx

File Size
11.8 MB

287 Pages
60,253 Words
414,833 Characters

turnitin Page 1 of 302 - Cover Page

Submission ID trn:oid::1:3334300418

turnitin Page 2 of 302 - Integrity Overview

Submission ID trn:oid::1:3334300418

6% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography
- Quoted Text

Match Groups

- 227** Not Cited or Quoted **5%**
Matches with neither in-text citation nor quotation marks
- 107** Missing Quotations **2%**
Matches that are still very similar to source material
- 0** Missing Citation **0%**
Matches that have quotation marks, but no in-text citation
- 0** Cited and Quoted **0%**
Matches with in-text citation present, but no quotation marks

Top Sources

- 5%** Internet sources
- 3%** Publications
- 1%** Submitted works (Student Papers)

APPENDIX 6; OBSERVATION GUIDE

NAME OF THE TEACHER;

LOCATION OF THE SCHOOL

1. How a teacher diagnoses student understanding	
2. How teachers give feedback	
3. How the teacher adjusts instruction	
4. teacher-student interaction	
5. student engagement	
6.CDA present or absent	

APPENDIX 7; Consent letter from school principals

This letter serves to grant MOIPONE MOKHETHI, from the National University of Lesotho, permission to conduct interviews with teachers at The

The purpose of these interviews is to gather data for the research study titled Exploring Teachers' Experiences with Using Cognitive Diagnostic Assessments in Primary Schools in Lesotho.

Yours sincerely.

Principal

APPENDIX 8; TEACHERS' CONSENT LETTER

CONSENT FORM

I, understand that I am being asked to participate in a research study about teachers' experiences with CDA in Lesotho.

I understand that my participation is voluntary and that I can choose not to participate or can withdraw from the study at any time without penalty.

I understand that the researcher will collect information from me through interviews and observations.

I understand that the information collected from me will be kept confidential and that my identity will not be disclosed.