

Methodology Article

Pre-Service Social Studies Teachers' Assessment Literacy in Ghana: A Convergent Triangulation Inquiry

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Abstract

The study explored how a convergent triangulation mixed-methods design promotes, challenges, and yields a convergent understanding of pre-service Social Studies teachers' assessment literacy research in a resource-constrained and high-stakes examination environment at the Senior High School (SHS) level in Ghana. The study employed the convergent mixed-methods design grounded in pragmatism. The study was influenced by Vygotsky's sociocultural theory, the Teacher Assessment Literacy in Practice (TALiP) framework of Xu and Brown, and Greene's dialectical stance (DS). Using a mixed-purposeful sampling technique, 76 final-year Bachelor of Arts (B. A) in Social Studies Education pre-service teachers at the University of Education, Winneba were selected for the study. Data collection was done using a validated questionnaire, semi-structured interviews, and video-recorded classroom observations. Ferretti et al.'s merging strategy was employed to guide data integration alongside Onwuegbuezie and Johnson's legitimization framework. The study revealed notable discrepancies between self-reported (questionnaire results) and observed (interview and observation results) assessment literacy (AL). The majority, 7 (70%) of participants demonstrated limited formative assessment practices during lessons, although 85% of them reported high levels of assessment competence. The convergent triangulation design proved valuable in uncovering the discrepancy between theory and practice, revealing the multi-dimensional nature of the pre-service teachers' assessment literacy (TAL), and producing meta-inferences that neither quantitative nor qualitative approaches alone could yield. The findings, therefore, emphasise the need for context-driven professional development and policy interventions to promote pre-service teachers' assessment literacy in Ghana.

Keywords

Assessment Literacy, Convergent Triangulation Design, Mixed-Purposeful Sampling, Dialectical Stance, Sociocultural Theory

1. Introduction

Educational assessment remains an important part of learning and teaching. A major revelation in many studies is the need for assessment, teaching, and learning to work synergistically (as each informs the others). The relationships imply that these three are inseparable. It is emphasised that assessment is not a time-wasting appendage to classroom practice

but an integral part of planning affective instruction [58]. A compelling argument for the role of assessment is presented by [57] when he asserted that if we intend to discover the truth about an educational system. We must investigate its assessment procedures and that "the spirit and style of student assessment define the de facto curriculum" [1, 57], that is, the

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Received: 11 April 2026; Accepted: 27 April 2026; Published: 24 July 2026



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curriculum as it operates in practice, as separate from its stated intentions. The viewpoints of [58, 57] substantiate the inextricable link among teaching, learning, and assessment. From this, it can also be concluded that assessment, as a powerful tool, can promote learning when planned and executed proficiently, or jeopardise it when done ineptly. This substantiates the ideal role of educational assessment in instruction. Similarly, [25] found that teacher assessment practices are the most effective means of optimising learning.

The pursuit of Sustainable Development Goal 4 (SDG 4), which seeks to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all [63], demands a paradigm shift in educational assessment practices, particularly in TAL in Ghana. Recent curriculum reforms at all levels in Ghana aim to improve the quality of education through competency-based standards [43, 44]. The 2023 SHS Social Studies curriculum, for instance, focuses on Depth of Knowledge (DoK) levels [44]. It emphasises that SHS teachers must be proficient in assessment practices to meet these learning outcomes and the curricular vision.

A teacher's AL and design competence framework, useful for training assessment-literate teachers, is also recommended by [29]. The framework has seven constituents of AL. These include assessment knowledge and skills, formative assessment, assessment identity, professional development, school environment, learner engagement, and the incorporation of digital assessment. Being an assessment-literate teacher implies being knowledgeable of and competent in the use of assessment. It is noted by [12, 23, 53, 54, 73] that a teacher's AL constitutes their knowledge and understanding of principles of assessment, their ability to design valid and appropriate assessment tools, interpret assessment data, and use emerging evidence to make informed instructional decisions.

From these postulations, it can be inferred that, characteristically, assessment-literate teachers in Ghana ought to close policy-practice gaps by becoming competent in formative assessment (including assessments for and as learning as well as ipsative assessment), data-inclined instruction, and digital tools. This warrants the development of teachers' professional identity and contextual awareness to meet the demands of any competency-based curriculum. For educational assessment to perform its vital role in effectively supporting teaching and learning and attain its ideal purpose, teachers, as a matter of necessity, possess a high level of AL. This is because teachers' AL significantly impacts the quality of pedagogical practices [6, 21, 23, 39, 41]. Unfortunately, studies also suggest that many teachers lack adequate AL to appropriately set the value of assessment in informing teaching and learning [24, 73]. Moreover, a strong case is made by [23] for empowering teachers to become more assessment-literate.

Studies in recent years have revealed significant dearths in teachers' assessment competencies across various African contexts [2, 3], with concerns about teachers' limited understanding of formative assessments, constructive feedback mechanisms, and evidence-based instructional adaptations. In

Ghana, for instance, while both the 2010 syllabi and 2023 SHS curriculum emphasise continuous and criterion/standards-referenced assessments [42, 44], empirical evidence suggests teachers' continuous reliance on traditional (summative) assessment approaches and examination-focused practices, which may compromise the quality education envisioned in SDG4 [1, 13]. The disconnect between policy intentions and classroom realities raises fundamental questions about the nature and extent of teachers' AL in Ghana, especially at the SHS level.

Existing research methodologies on AL have often been restricted to quantitative or qualitative approaches, thereby limiting a comprehensive understanding of the contextual realities shaping teachers' assessment practices [15]. Such studies, often conducted through mono-method approaches, have produced broad but shallow findings. Similarly, qualitative studies usually generate findings that are contextually rich but methodologically narrow in scope. It is noted, for instance, that quantitative studies on the one hand, seldom capture depth and context [24]. On the other hand, qualitative studies generate rich insights while failing to address broader issues across diverse educational contexts. This methodological enigma constitutes a significant gap, considering the complex nature of AL.

Mixed methods research is an effective approach for examining teachers' assessment knowledge, beliefs, and practices, as affirmed by [19, 27]. This approach allows for an exploration of contextual factors and barriers influencing teachers' assessment practices [19], particularly relevant in Ghana, where legacies of colonialism and high-stakes examinations significantly shape the dynamics of teaching [5, 9, 22]. The study, therefore, sought to find answers to the following methodological questions in relation to AL at the SHS in the context of Social Studies:

- 1) How does the use of convergent triangulation mixed-methods design promote pre-service teachers' AL research while yielding methodological insights?
- 2) What methodological challenges does the convergent triangulation mixed-method design pose for AL research in a resource-constrained and high-stakes examination context? and
- 3) What convergent understandings emerge from integrating quantitative and qualitative data strands in AL?

By analysing data from seventy-six (76) Bachelor of Arts (B. A.) in Social Studies Education trainee teachers using a convergent triangulation mixed-methods design, my study identified disparities between self-reported assessment conceptions and actual practices, demonstrating the need for tailored professional development and policy interventions in Ghana's educational system.

2. Theoretical Framework

The study adopted an integrated sociocultural theory [69,

[70] with the TALiP framework proposed by [73], the Dialectical Stance on Mixed Methods Research by [30, 47]’s legitimisation framework.

2.1. Vygotsky’s (1978/1987) Sociocultural Theory (ST)

The sociocultural theory of [69, 70] underpins my study. In the context of this study, the theory emphasises that AL is socially constructed and developed by trainee teachers. The construction is often through interaction with more knowledgeable others and cultural tools, especially those with authentic assessment experiences. The theory thus has profound implications for classroom assessment practice. The theory specifically underscores the importance of collaborative practice, dialogue, mentoring relationships, and the cultural context of teaching and learning, rather than isolated skill acquisition.

2.2. Xu and Brown’s (2016) TALiP Framework

Like [69, 70]’s sociocultural theory, the TALiP model by [73] focuses on how teachers use assessment knowledge in relevant, authentic contexts. In other words, the TALiP is inextricably linked to teachers’ conceptions of assessment, the local contexts, and their pedagogical content knowledge. This is contrary to [62]’s technical skills-oriented conceptualisation of AL. The focus of [73]’s model is on praxis rather than theory. The model encompasses six domains: (1) Knowledge base, (2) Teacher conceptions of assessment, (3) Institutional and socio-cultural contexts, (4) TALiP, (5) Teacher learning, and (6) Teacher identity (re)construction as assessor.

An explanation is given by [73] on how the knowledge base of their praxis-oriented model ((a)disciplinary knowledge and pedagogical content knowledge; (b) knowledge of assessment purpose, content and methods; (c) knowledge of grading; (d) knowledge of feedback; (e) knowledge of peer and self-assessment; (f) knowledge of assessment interpretation and communication; and (g) knowledge of assessment ethics)) that, for instance, empowers teachers to construct their conceptions of assessment that are delineated in a country’s curricular framework and or curricula. They further argue that knowledge based on assessment, discipline, and the assessment ethos is necessary for establishing criteria through which the extent and appropriateness of assessment can be critiqued [73].

The use of [73]’s TALiP is relevant for my study because (1) [69, 70]’s sociocultural theory explains that trainee teachers learn through interaction with more knowledgeable others and cultural tools, without indicating what the concept of AL is. The TALiP bridges this gap by detailing six specific domains as above. The domains outlined by [73] give practical meaning to the concept of AL. The sociocultural theory of [69] was used to explain how trainee teachers cultivate the six domains recommended by [73]. The cultivation of these domains through the sociocultural lens can be achieved mainly through

collaborative practice. For example, in the context of my study, such collaborations should be between the trainee teachers, their colleagues, and university supervisors. Similarly, [69, 70, 73] concur that such collaborations should be manifested through dialogue, mentoring relationships, and interaction with assessment tools during their initial training and beyond.

2.3. Greene’s (2007) Dialectical Stance (DS)

Methodologically, the study is grounded in the dialectical stance (DS) on mixed methods by [30]. Generally, the DS provides an epistemological guarantee for mixing methods. The dialectical way of thinking conceptualises qualitative and quantitative approaches as complementary rather than in conflict [30, 31]. This, according to [19], facilitates the collection of data that captures the breadth and depth of a phenomenon, particularly in my study, trainee teachers’ AL. This underlying exposition within a dialectical stance seeks to better appreciate trainee teachers’ AL as a complex social phenomenon by deliberately incorporating multiple ways of knowing and valuing, and by valuing diversity. A dialectical stance validates my study’s focus on trainee teachers’ AL through multiple pragmatic perspectives [30], aligning with [73]’s TALiP meaning-based orientation and the progressive lens of [69, 70]. This integration enables divergent thinking to yield deeper insights.

2.4. Onwuegbuzie and Johnson’s (2006) Legitimation Framework

The legitimation framework by [47] and extended by [51] provides and facilitates quality standards for integration. Therefore, in merging quantitative measurements of the TALiP domains with sociocultural development processes, my study aimed to meet this requirement. The legitimation theory establishes methodological rigour by addressing sample integration, inside-outside, weakness minimisation, sequential data conversion, paradigmatic mixing, commensurability, multiple validities, and political forms of legitimation [47]. This confirms that the integration of mixed-methods data elicits meta-inferences about how trainee teachers become assessment-literate through socially constructed contexts. This apparently provides not only theoretical clarity regarding what teacher AL entails and develops, but also, convergently, draws on methodological legitimacy for examining a nuanced phenomenon of this sort employing myriad parallel perspectives.

3. Literature Review

3.1. Conceptual Foundations of Teachers’ Assessment Literacy

The concept of Assessment Literacy (AL) has evolved from [62]’s narrow focus on measurement or psychometric orienta-

tion and principles toward a broader, sociocultural, and contextual construct that entails teacher identity, beliefs, ethical considerations, and contextual awareness [7, 24]. The early Standards for Teacher Competency in Educational Assessment of Students [4] reflected this measurement-oriented tradition. These definitional traditions are critically distinguished by [71] by their fundamental assumptions, whether scientific-technicalist or socio-cultural. The argument here is that robust conceptualisation of AL must identify learners as the primary focus of assessment, situate assessment as a tool for optimising learning, and recognise the social context within which assessment operates. From these perspectives, AL can be explained to mean teachers' knowledge, beliefs, dispositions, competencies, and the ability to design context-specific, valid assessment items; interpret evidence of learning; and differentiate pedagogical approaches accordingly [23, 53, 54, 73].

Notably, however, possessing this knowledge is not a guarantee for its enactment. Numerous systematic constraints, including teachers' own schooling experiences and the conceptual detachment of assessment from teaching and learning, are identified by [60] as significant barriers to the development of in-service and pre-service teachers' AL. These constraints are profound in Ghana, where [8] found that high-stakes examinations are reinforced by the classification of SHS schools into categories A, B, C, and D schools, and the dominance of the West African Senior Secondary Certificate Examinations (WASSCE) compels teachers to teach to the test. This examination-focused culture fundamentally undermines meaningful and learning-oriented assessment practices, formative and criterion-referenced assessment vision of the 2023 SHS Social Studies curriculum [44], which clearly requires teachers to balance both formative and summative assessments aligned with the DOK levels.

It is further confirmed by [40, 46] that assessment-literate teachers must gather reliable evidence of student learning, design assessments aligned with learning outcomes, while advocating for equitable assessment practices. The theory-practice lacuna between what teachers know about assessment and actualise encompasses the main problem that the current study explored. As [50] notes, understanding the lacuna requires research designs capable of capturing both depth and breadth (teachers' knowledge and understanding, functional skills, and evidence-based decision-making) simultaneously.

3.2. Convergent Triangulation Designs in Educational Assessment Research

The convergent triangulation design, in which quantitative and qualitative data are collected simultaneously, given equal priority, and compared during interpretation to determine convergence, divergence, or complementarity [18, 20], is especially appropriate for investigating the multi-dimensional nature of TAL. Its value has been demonstrated across similar educational research contexts. For instance, studies by [10, 68, 38] generally found that gaps between teachers' stated beliefs

and actual instructional practices are best revealed through mixed methods approaches that combine both observational and self-reported data. Thus, contextually embedded, collaborative professional learning, instead of isolated skill acquisition, is necessary to close the gap. The findings directly envisage the methodological argument of the current study.

For AL research specifically, the convergent design enables simultaneous measurement of teachers' assessment conceptions through a self-administered questionnaire while exploring trainee teachers' reasoning and decision-making through qualitative methods [39]. The affinity of this design, according to [23], lies in its capacity to capture not only technical expertise but also contextually embedded practices shaped by policy frameworks, institutional cultures, and teachers' own pedagogical beliefs and experiences, dimensions that, according to [11, 19], mono-method alone cannot adequately address.

Whereas sequential mixed-methods designs have been widely used in AL research, fewer studies have arguably employed convergent triangulation designs to examine diverse dimensions of AL simultaneously. This is a gap my study sought to address, especially within Ghana's resource-constrained and high-stakes examination context [8, 13], where the 2023 SHS Social Studies curriculum DOK-aligned framework [44] exactly requires pluridimensional, evidence-based assessment practice that convergent triangulation design is distinctively situated to explore.

3.3. Mixed Methods Data Integration Techniques for Investigating Teacher AL

The quintessential and commonly untapped feature of mixed methods research is efficient data integration [28]. Three main integration approaches are identified by [28]: merging, connecting, and embedding, each serving unique analytical purposes. Merging enables direct comparison of quantitative and qualitative results to identify congruence or incongruence; connecting ensures that one data strand informs the analysis of the other; and embedding places one data type within the broader framework of the other. For AL research, integration is significant, as it facilitates the juxtaposition of pre-service teachers' assessment knowledge, beliefs, and attitudes against observed classroom practices. This is precisely the kind of integration strategy adopted in the present study.

The significance of integration is well evidenced empirically. A study by [11] found that teachers sharing a similar level of assessment conceptions (quantitative assessment) frequently adopted markedly different classroom assessment practices, shaped by contextual beliefs and institutional constraints, insights that only data integration could reveal. Such meta-inferences, emerging from the convergence and divergence of merged datasets, align with the overall epistemological goal of the convergent triangulation design in TAL research. This, according to [18], helps in revealing complex relationships among trainee teachers' knowledge, beliefs, dispositions, aptitudes, and practices that may remain uncovered in

mono-method research. Integrating data effectively requires researchers to navigate between qualitative and quantitative approaches while preserving the integrity of each.

3.4. Methodological Rigour and Legitimation Mixed Methods Educational Assessment Research

Establishing methodological rigour in mixed methods research is operationalised through legitimation, that is, the validity of inferences derived from the integration of quantitative and qualitative findings [34, 47, 49]. The nine-type legitimation typology, which includes sample integration, inside-outside, weakness minimisation, sequential, data conversion, paradigmatic mixing, commensurability, multiple validities, and political legitimation, provides a framework essential for mixed methods research on TAL. This typology is extended by [51] by incorporating under-researched populations and non-Western educational settings [71]. This is an extension directly relevant to the present study, where colonial legacies and high-stakes examinations educational assessment practices [8, 22] create legitimation-related issues not entirely resolved by the framework of [47, 49]. Notably, legitimation in AL studies demands attention for both quantitative content validity and qualitative trustworthiness. It is against this background that [71] admonishes that data collection instruments designed in Western contexts often lack sociocultural adaptations for non-Western situations.

This concern is similarly echoed by [73, 74] who postulate that content validity must be established together with qualitative trustworthiness through peer debriefing, member checking, and thick description. It is further emphasised by [26, 59] that rigorous integration requires transparency in analytical procedures, clear documentation of convergence and divergence patterns, and reflexive acknowledgement of researcher positionality. Studies on TAL in recent times have incorporated pilot testing, expert interviews, triangulation across diverse qualitative sources, and systematic combined displays to enhance legitimation [75]. These studies have strengthened meta-inferences and contributed methodological knowledge to the broader discourse on mixed methods research [76].

3.5. Methodological Challenges and Solutions in Convergent Triangulation Assessments Research

Researching teachers' AL using a convergent triangulation design is not without methodological challenges. This often happens during data collection, analysis, and integration. The first among the challenges is the selection of data collection instruments. Quantitative methods, such as surveys and statistical analyses, efficiently identify patterns and trends across large datasets [55]. Nonetheless, these large data sets often cannot explain why such patterns exist or how they manifest in actual classroom settings. For example, in the Ghanaian

SHS context, a questionnaire may reveal that pre-service Social Studies teachers report difficulty designing DOK-aligned assessment tasks, a main requirement of the 2023 SHS Social Studies curriculum [44]. Nevertheless, only qualitative methods, such as observation, interviews, and focus groups, can reveal such contextual factors underpinning these difficulties, including class size, the influence of mentors, and resource constraints [56]. Designing mixed-methods-appropriate instruments that combine standardised Likert items with open-ended responses and structured observation indicators is therefore crucial for fully capturing the complex components of AL [73, 76].

The second challenge relates to the timing of data collection. Logistics can impede truly concurrent collection [16, 17], and close temporal sequencing of data types from the same participants may result in response bias and cross-contamination. To overcome such a challenge, [72] recommends the deliberate design of clear data-collection sequencing instruments.

The most concomitant challenge in convergent triangulation studies, however, is data integration. It is noted by [28] that many mixed-methods studies collect both data types yet fail to integrate meaningfully. A challenge that is particularly costly in AL, where quantitative measures of conceptions often diverge from qualitative evidence of practice. Successful integration, therefore, requires methodological bilingualism [32, 49, 65] to ensure legitimation. In the context of my study, and as deduced from [32], this term denotes the researcher's ability to navigate between paradigmatic boundaries while preserving the integrity of each approach. The challenge was particularly critical in my study because the 2010 SHS Social Studies curriculum emphasised continuous and criterion/standards-referenced assessments [42]. This thus suggests that divergence between self-reported and observed AL was not simply a methodological impediment but a significant finding about the depth of pre-service teachers' assessment competencies.

Lastly, sampling discrepancies between quantitative and qualitative strands exacerbate comparability of data [66]. This is compelling across diverse educational contexts, where designing potentially meaningful assessments requires different question/item types to establish authenticity and comprehensiveness. This issue can be addressed through nested sampling, where qualitative participants are purposively sampled from within the larger quantitative cohort [64]. This is a strategy that was employed in this study.

4. Methods and Materials

4.1. Research Design

The study employed a convergent triangulation mixed-methods research design, as espoused by [18, 20], anchored in the pragmatist paradigm [18], to explore the AL of B. A Social Studies Education pre-service teacher at the University of Education, Winneba, Ghana.

4.2. Sample and Sampling Technique

Participants were sampled out of a population of 315 final year Bachelor of Arts in Social Studies students based on the mixed purposeful sampling strategy [48]. Concerning the quantitative strand, 76 (43 males, 56.6%; 33 females, 43.4%) participants were sampled, representing 24.12% of the population. Although [37] proposes about 172 participants for a population of 315, the sample of 76 for my study is methodologically appropriate, given its descriptive nature, resource

constraints, and the complementary depth offered by the qualitative stream [20, 48]. Similarly, ten (10) participants were purposively sampled from the 76 through volunteer (opt-in) sampling for the qualitative phase of the study, thus, for the semi-structured interview and observations. This aligns with the nested sampling logic [48], confirming direct comparison between quantitative and qualitative findings while tackling legitimization [47]. Table 1 presents a summary of the sampling as follows:

Table 1. Summary of Sampling Procedure.

Methodological Strand	Sample	Sampling Strategy	Justification
Quantitative	76	Mixed purposeful sampling	Descriptive (quantitative) breadth, pragmatic resource constraints, augmented by qualitative depth
Qualitative	10 (nested within the 76)	volunteer (opt-in)	nested sampling logic and
Overall Design	convergent nested	convergent design using nested samples for the qualitative and quantitative components of the study [48] and legitimization [47].	Sample integration legitimization, challenges of integration addressed

Source: Adapted after Onwuegbuzie and Collins (2007) and Onwuegbuzie and Johnson (2006).

4.3. Methods and Instruments of Data Collection

Three instruments for data collection were employed. They included (a) a Pre-service Teachers' Assessment Literacy Questionnaire (PsTALQ) adapted after [36, 52] (b) a semi-structured interview guide, and (c) an observation protocol that adapted aspects of the Physical Education Teacher Evaluation Tool (PETET) [45], and the Formative Assessment Classroom Observation and Lesson Planning Tool (FACOLPT) [33, 67] for systematic observation of the B. A Social Studies pre-service teachers' classroom assessment practices. Although PETET originates from a different subject area, its applicability to the focus of my study necessitated adaptation. Both PETET and FACOLPT identify the knowledge, skills, and behaviours required to provide sound instruction and assessment in pre-tertiary education classrooms.

The questionnaire was administered online via Google Forms to all 76 respondents. Ten (10) out of the 76 were also selected through volunteer (opt-in) sampling to participate in semi-structured audio-recorded interviews, and video-recorded classroom/lesson observations of the same 10 respondents. The questionnaire comprised 27 items, organised into sections covering demographic information, purposes of assessment, assessment types and cognitive levels, self-rated AL, professional development needs, and influencing factors. Likert-type scales were used for most items. The semi-structured

interviews explored participants' conceptions of the 2010 Senior High School Social Studies curriculum, their understanding of assessment, their assessment practices, the factors influencing these practices, and their professional development needs. Interviews were audio-recorded and transcribed verbatim. The adapted observation protocol focused on the trainee teachers' instructional tasks, assessment, feedback, and inclusive practices.

Video-based observations were used because they helped eliminate observer bias and the Hawthorne effect and allowed multiple researchers to analyse identical pedagogical and assessment episodes, thereby improving inter-rater reliability and triangulation. Classroom videos have become a prominent tool for education research because of their ability to capture rich, complex interactions [61]. Observation of pre-recorded videos enables researchers to code and analyse data from different perspectives. Similarly, the post-observation debriefing exercise held with those observed promotes self-reflection, monitoring, and self-assessment among teachers [35].

4.4. Methods of Data Analysis

In line with the design, data analysis and presentation were done in two stages (quantitative and qualitative phases). The quantitative data were analysed and presented using simple descriptive statistics (means and standard deviations) in Microsoft Excel. The descriptive statistics depicted what was found and allowed me to describe the distribution of, and relationship among, for example. Patterns across respondents'

self-reported AL, their understanding of the concept of assessment, its purposes or uses, and formative assessment practices (assessment ‘for’ and ‘as’ learning). Other variables identified, analysed, and presented included factors influencing the pre-service teachers’ assessment practices and their professional development needs. Also executed in Stage One was the application of [14] six-stage thematic analysis. This was applied to the pre-recorded video observation notes and interview transcripts through repeated readings, line-by-line coding, and pattern identification. This exercise yielded four main themes: (i) conceptions and purposes of assessment, (ii) observed classroom practices, (iii) contextual factors influencing the teachers’ assessment practices, and (iv) professional development needs/challenges.

All data obtained from the three main sources were merged during the presentation and interpretation phase, marking the second stage. Efforts were made to confirm, cross-validate, and corroborate the findings. Lastly, the two datasets were converged to depict the complete picture of pre-service teachers’ AL. As a result, I was able to determine the scope of data convergence and how the self-reported online survey results and themes were alike [18]. A matrix was created depicting the major responses of participants’ interviews along with the questionnaire data. Through the matrix, points of convergence, divergence, and complementarity were identified. The data integration or merging was guided by the framework proposed by [47], which addressed the following potential legitimization threats: sample integration, weakness minimisation, multiple validities, inside (emic)-outside (etic), political, and conversion legitimations. This was done to ensure the credibility, trustworthiness, and overall quality of the meta-inferences deducted.

5. Findings

The convergent triangulation design yielded several important methodological insights in AL. These insights emerged from the implementation process, challenges encountered, and the integration of findings from different data sources.

5.1. Discrepancies Between Self-Reported and Observed Assessment Literacy

A significant methodological insight from the convergent triangulation design was its ability to unearth discrepancies between self-reported AL and observed assessment practices. The questionnaire findings indicated high levels of self-reported AL, with 85% of respondents rating themselves between 6 and 10 on a 10-point scale. Participants also reported frequent use of assessment for formative purposes, with mean scores of 4.33 (SD=0.62) for "helping students improve learning" and 4.57 (SD=0.62) for "addressing issues of diversity, equity, and inclusivity."

Notwithstanding the high frequency of use of assessment for formative purposes reported in the quantitative results, observation data depicted the reverse. For instance, only 3 (30%) of the observed participants exhibited practices aligned with the principles of formative assessment. This means that most (70%) of the participants failed to elicit evidence about the students’ learning during lessons or to engage their learners in self- and peer-assessment. One participant during the interview session noted:

"I was just doing as directed by my mentor. In fact, to say that it [my assessment literacy] is high or very [high], I will be telling lies because I was not even sure of the answers I gave to the previous questions... Seriously, we just do as we see our mentors do" [Interviewee 2].

This discrepancy would have remained hidden with a single-method approach. The collection of self-reported, semi-structured, and observational data, and the use of data convergence, enabled direct comparison of the diverse data sets. Employing this design has revealed a significant gap between theoretical knowledge and practical implementation, whose integrated understanding emphasises the usefulness of triangulation in teacher AL research, where the PsTALQ (self-reported questionnaire) alone may yield a partial or misleading picture. Table 2 presents a discrepancy matrix illustrating the discrepancies between pre-service teachers’ self-reported and observed AL.

Table 2. Discrepancy Analysis Matrix Between Self-Reported and Observed Assessment Literacy.

Assessment Literacy Indicator	M	SD	Observed Discrepancy (Key Finding)	Data Source
Overall Self-rated Assessment Literacy (10-point scale)	7.6	2.1	57/67 (85%) rated themselves $\geq 6/10$, yet only 3/10 (30%) demonstrated formative assessment in practice—a 55% gap	PsTALQ Data
Formative Purpose of Assessment (Assessment for and as Learning)				
Helping students improve learning and class performance.	4.33	0.62	High self-reported, but observed practice showed no evidence-eliciting, feedback, or peer- and self-assessment	PsTALQ Data
Addressing issues of diversity, equity, and inclusion	4.57 (highest)	0.62	Overall, the highest mean in the entire dataset, but no differentiation assessment was observed during instruction.	PsTALQ Data
Formative assessment practices observed during internship	30%	-	Only 3 out of 10 observed participants demonstrated formative alignment; practice was mainly summative and mentor-directed	Observation data

Assessment Literacy Indicator	M	SD	Observed Discrepancy (Key Finding)	Data Source
Participant self-awareness of over-reporting during interviews	-	-	...to say that it [my assessment literacy] is high or very [high], I will be telling lies ... (Interviewee 2) directly contradicts questionnaire responses	Semi-structured interview
Methodological Implications (Triangulation vs. single-method approach)	-	-	The gap would have remained undetected with PsTALQ alone; convergent triangulation exposed the gap between knowledge and practice	Convergent triangulation

Source: Field Survey, 2019. n=67 (out of 76 total respondents)

The data in Table 2 reveal that, out of the 76 respondents, 67 (88.2) respondents who completed the 10-point bipolar semantic differential self-rating item, 57 (85%) rated their overall AL high or very high. Thus, selecting between 6 and 10 ($M=7.6$, $SD=2.1$), while the remaining 10 (15%) rated their AL as low or very low, selecting between 1 and 5 scale points. These statistics show that pre-service Social Studies teachers' self-reported AL was relatively high, indicating an inclination towards sociocultural and social meliorist conceptions of assessment [7, 69], where assessment is held as inseparable from teaching and learning. The observation data, however, revealed the opposite, where only 3 (30%) of the 10 participants demonstrated formative assessment practices. This reveals a significant 55% theory-practice gap between what the pre-service teachers said they could do and what they did during instruction. This confirms [1]'s assertion that pre-service teachers are unable to elicit evidence relevant to learners' progress as aligned to lesson and curriculum goals. The effect is that pre-service teachers cannot determine whether their students can optimise learning.

5.2. The Multi-Dimensional Nature of Assessment Literacy

The convergent triangulation design comprehensively captured the multi-dimensional nature of AL, revealing a nuanced

dissonance between theoretical understanding and practical application. Quantitative data captured respondents' understanding of assessment purposes and techniques, while qualitative data revealed participants' challenges in applying this knowledge in classroom contexts. For instance, the questionnaire responses indicated that respondents understood the three main purposes of assessment, with mean scores indicating an in-depth understanding, as shown in Table 3. However, data from both the observation and the interview reported differences in how participants understood and applied these specific purposes of assessment during lessons.

This situation suggests the existence of a lacuna in the participants' conceptual understanding and actual classroom practice. As most interviewees could explain theoretical understanding, their practice (as observed) mainly focused on summative assessment (assessment of learning). The following is what an interviewee said about summative assessment:

Academically, I can say that one is to conduct the summative assessment for grades, grades, yeah [Interviewee 1].

The different methodological perspectives demonstrate how convergent triangulation allows researchers to go beyond examining breadth (patterns across respondents/participants) to examine depth (individual pre-service teachers' conceptions and practices) of AL. Thus, the merging of findings from the two data sets presented a more complete picture than a mono-method or approach could offer.

Table 3. Multi-Dimensional Nature of Assessment Literacy.

Assessment Literacy Indicator	M	SD	What it shows	Data Source
Assessment of Learning: Summative/grading	3.98	1.01	Best understood dimension: Respondents conceive assessment primarily as measuring and grading final learning outcomes	PsTALQ Self-report
Assessment for Learning: Diagnostic/instructional	3.87	0.92	Understood in theory as informing and improving teaching and learning, yet qualitative data revealed limited practical application	PsTALQ Self-report
Assessment as Learning: Metacognitive/self-regulatory	3.47	1.01	Least understood dimension: lowest mean and highest variability signal uneven understanding of student self-reflection as a purpose of assessment.	PsTALQ Self-report
Theoretical vs practice gap	-	-	Participants could describe all three purposes, yet observed practice was predominantly summative: "...one is to get the summative assessment for their grades" (Interviewee 1)	Observation and interview data

Source: Field Survey, 2019

Note:

- 1) The self-reported Data (in [Tables 2 and 3](#)): The ratings on the overall AL are on a 10-point bipolar self-assessment scale. Similarly, the individual means (M) and standard deviations (SD) from the PsTALQ and a 5-point Likert scale ([Table 3](#)).
- 2) Observed Data: The observational frequencies are obtained from the convergent observational strand of the study. The 30% in [Table 2](#) illustrates the proportion of observed participants whose instructional practices parallel formative assessment principles.
- 3) Items indicated with (-) are qualitative constructs obtained from the semi-structured interview, observational, or convergent data. In their case, quantitative descriptive statistics do not apply. conducted.

5.3. Enhancing Sampling Through Volunteer Panels

Employing mixed purposeful sampling, integrating pre-recruited survey and volunteer (opt-in) sampling, was appropriate. This type of sampling technique in mixed-methods research offers numerous insights. This was effective for accessing participants with different levels of AL. The means via which the online questionnaire was shared yielded a wide range of respondents (n=76/315) for the quantitative data. The qualitative data were collected using volunteer (opt-in) panels, of which 10 participants participated in the interview and observation. This is from the 10 participants guaranteed committed participation.

Even though the mixed purposeful sampling technique proved to be effective, there emerged some notable limitations too. For instance, considering the selection of the 10 participants through volunteer (opt-in) for the qualitative phase of the study, some biases might have been introduced. This is on the premise that the volunteer (opt-in) method only considered participants who were more willing to participate. This justifies the need for the acknowledgment of sampling challenges in convergent triangulation designs, especially when the integration of data demands comparing data from diverse sub-samples.

5.4. Navigating Integration Challenges

Integration of data from the two data sets does not come without methodological challenges. These challenges provide insights for future research. In the context of my study, prominent among the challenges faced were the contradictions among the various data sources. For instance, the PsTALQ responses revealed higher levels of AL and the frequency of use of formative assessment. The PsTALQ data further indicated a sound theoretical understanding and intentions. However, qualitative data from the semi-structured interview and observation contradicted the PsTALQ response. The qualitative

data demonstrated that pre-service teachers' use of formative assessment methods was limited in their actual instructional practice. To overcome this contradiction, I carefully consider what each data set captured. Therefore, rather than treating this as a limitation, the disparity yielded critical findings that exposed the nuanced nature of AL development in diverse contexts.

Establishing the due weight to assign to each data source was yet another integration-related limitation. Evidence from the study suggests that both quantitative and qualitative data sources were given equal weight through the design. Nonetheless, the most revealing of all data, especially about the pre-service teachers' assessment practice, came from the observation data. This thus brought about much greater emphasis on the qualitative findings during data integration, especially when proffering recommendations on teachers' assessment practices. This challenge emphasises the need to address issues of reflexivity and flexibility in a convergent triangulation mixed-methods research design. This is confirmed by [\[27\]](#), who argued that data integration should be informed by research questions as well as the nature of findings. This, they recommend, in preference to rigid compliance to pre-determined schemes for data sources [\[27\]](#).

5.5. Strengthening Quality of Rigour via Multiple Validities

Employing the convergent triangulation mixed-methods design enhanced the methodological rigour of my study. This was possible through the legitimization framework of [\[47\]](#). For instance, to address the issue of the validity of the overall findings, meta-inferences drawn from combined data were supported by eclectic data sources. With my study focused on teacher AL, for instance, the content validity of the quantitative data was addressed through pilot testing and expert interviews as [\[71\]](#) recommended. Similarly, trustworthiness of the qualitative findings was established through peer debriefing, member checking, and thick description.

The identification of divergence, convergence, and complementarity across the TALiP domains was also established. For instance, both data sets corroborate the existence of contextual factors that symbolically influence pre-service teachers' assessment practices. This shows that the convergent triangulation mixed-methods design ensures the quality of rigour of educational research by providing different lines of verification for findings.

6. Discussion

6.1. Interpreting the Theory-Practice Gap Via a Vygotskian Lens

The differences between participants' self-reported AL and

their observed practices were better understood through the sociocultural framework, specifically, the mediating roles of the Zone of Proximal Development (ZPD) [69, 70] and psychological tools in shaping what pre-service teachers do during Off-Campus Teaching Practice (OfCTP). The internship programme functions as a sociocultural arena in which newly formed AL, acquired by the pre-service teachers during the pre-internship studies, was tested. Also, practices from the school environment and mentors influence their assessment practices. Interviewee 2's acknowledgement that:

We just do as we see our mentors do [Interviewee 2]

This indicates a process of apprenticeship in which the mentor functions as the more knowledgeable person within the ZPD [69, 70], whose summative assessment practices serve as a model for the intern. By implication, participants' high self-reported scores serve as a likely reflection of information that was operationally learnt upon entry into a culture that undermines formative and ipsative assessment in their various schools. The existing cultures that interns learnt from were: lesson-plan templates, mentor feedback practices, and examination syllabi, particularly influencing summative conceptions, leaving out the broader understanding of AL, even when it has been learnt. The convergent triangulation design was relevant to making this mediating layer visible by separating the site of self-report from the site of practice.

6.2. Re-engaging the TALiP Framework in the Interpretation of Findings

The TALiP framework by [73] reconceptualises AL as a dynamic, multi-dimensional set of understandings and practices distributed across six interrelated domains. The findings of this study provide empirical evidence for most of TALiP's conceptualisation. Within Domain 2 (pre-service teachers' conceptions of the purpose(s) of assessment), quantitative data revealed in-depth theoretical understanding with a Mean Score of 3.47-3.98 across the three purposes of assessment. However, the qualitative and observational data revealed a decline in summative assessment orientation during the OfCTP, particularly the kind of declarative-to-enacted dissonance that the TALiP framework is designed for. Domain 1 (professional identity and self-efficacy) is influenced by the higher self-reported scores and minimum variability ($SD = 0.62$) on formative items, indicating that participants had internalised an identity as assessors-for-learning that was inadequately grounded in practical application to withstand the socialising culture during the internship teaching. Domain 3 (contextual factors) is directly supported by both quantitative and qualitative strands: quantitative items concerning internship conditions ($M = 2.93$), class size ($M = 3.28$), and syllabus load ($M = 2.92$) revealed structural constraints and the qualitative data also showed mentor dependency as a factor hindering formative assessment practices.

Finally, Domain 5 (professional learning disposition) is addressed by the convergence of high perceived Professional

Development (PD) need; rubric creation ($M = 4.03$), assessment planning ($M = 4.08$), marking and scoring ($M = 4.33$), with interview evidence revealing a lack of certainty about what appropriate support looks like. Both data indicate that any TALiP-informed PD programme must develop contextually adaptive assessment practices, not just technical skills.

6.3. Methodological Contribution of Convergent Mixed Methods Design to AL Research

My study makes a significant methodological contribution to AL research in the context of teacher education. The methodological insights build on and extend previous mixed-methods research on TAL in various significant ways. [23, 24] established the structural parameters of TAL at scale; however, their reliance on self-report instruments means they consistently produce data on what teachers believe about their practice rather than on what they do. This study addresses this challenge directly by integrating observational and interview data with the PsTALQ. [11, 39] advanced this by incorporating qualitative components; however, both studies were conducted with established teachers in Western contexts. This study, therefore, extends their insights to pre-service teachers in a Ghanaian context on internship, demonstrating that the sociocultural dynamics they identified, such as mentor influence, institutional culture, and assessment identity, are not only present. They are, however, arguably more accurate when interns are in a structurally dependent position.

The study's most significant contribution lies in its operationalisation of the integration principle identified by [28] as the defining and most frequently unrealised characteristic of mixed methods research. Rather than treating quantitative and qualitative data as parallel data types, this study employed data convergence and integration to generate interpretations that are genuinely emergent from their conjunction. The identification of divergence, convergence, and complementarity across the TALiP domains constitutes an epistemological claim about the differential contribution of each data type.

In consonance with [19], the study demonstrates that the value of mixed methods design lies not in combining data types but in the interpretations that integration produces. Most critically, it shows that the PsTALQ alone is structurally incapable of detecting the theory-practice gap, and that identifying the sociocultural mechanisms that produce it requires genuine integration rather than a single data site. This dual contribution (substantive and methodological) positions the study as a significant entry point for future mixed methods on TAL research in comparable global south teacher education contexts.

7. Conclusions

The study examined the methodological understanding of pre-service Social Studies teachers' AL in Ghana using a convergent triangulation mixed-methods design. Findings of the

study demonstrated that the convergent triangulation mixed-methods design offers significant methodological benefits for research in AL. Based on the findings, the study most importantly revealed a clear gap in theoretical knowledge and practical implementation (85% of respondents self-rated their AL highly, as against 30% demonstrating observable formative assessment practices during lessons). This is a discrepancy that could have remained covert in a mono or single-method research approach. This proved that AL is not a uni-dimensional construct generalised as theoretical knowledge. It, however, includes interconnected conceptual, contextual, situational, and dispositional elements. Thus, whereas pre-service teachers had a theoretical understanding of assessment for, as, and of learning, their actual classroom practices remained predominantly summative (assessment of learning). This was primarily because the pre-service teachers mimicked the mentor's behaviour instead of autonomously applying what they had learned. Consequently, self-reported data alone produce a grossly inadequate, incomplete, and potentially misleading picture of assessment competence. This corroborates the paucity of theory-focused data collection instruments as the primary means for exploring teachers' AL.

8. Recommendations

The findings of this study convey important implications for both practice and methodology. Institutions offering teacher education programmes must deliberately formalise and enforce observation-based assessments, reviews of video-recorded lessons, and well-coordinated internship or practicum feedback as standard assessment tools. Similarly, mentors ought to be trained to implement formative assessment appropriately and effectively. Teacher education curricula should therefore be reorganised to intentionally and explicitly help pre-service teachers or teachers develop all three components of AL via continuous participation within actual classroom assessment contexts.

In terms of methodology, researchers examining intricate educational phenomena ought to prioritise the mixed-methods approach, for instance, the convergent triangulation design. This is because when used appropriately, this mixed-methods design can produce complementary, divergent, and convergent datasets relevant to the problem under study that no single method could provide. To assure the quality of meta-inference, the study also recommends legitimisation frameworks, specifically the nine typologies suggested by [47]. Also, researchers need to ensure that the same participants are used for both quantitative and qualitative strands. This allows for direct comparison between quantitative and qualitative findings. The findings, thus, emphasise the need for context-driven professional development and policy interventions to promote pre-service teachers' AL in Ghana, especially with the introduction of the outcome-based curriculum at the SHS.

Abbreviations

AL	Assessment Literacy
BA	Bachelor of Arts
DS	Dialectical Stance
FACOLPT	Formative Assessment Classroom Observation and Lesson Planning Tool
M	Mean
OfCTP	Off-Campus Teaching Practice
PETET	Physical Education Teacher Evaluation Tool
PsTALQ	Pre-service Teachers' Assessment Literacy Questionnaire
SHS	Senior High School
SD	Standard Deviation
SDG	Sustainable Development Goal
TAL	Teacher Assessment Literacy
TALiP	Teacher Assessment Literacy in Practice
WASSCE	West African Senior Secondary Certificate Examinations
ZPD	Zone of Proximal Development

Author Contributions

Mohammed Adam: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing

Conflicts of Interest

The author declares no conflicts of interest.

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