

Voices Behind the Code: Teachers' and Students' Perspectives on Coding Literacy Integration in ELT

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Abstract

Coding literacy is increasingly framed as a cross-disciplinary competency, yet how it is perceived and experienced within English as a Foreign Language (EFL) classrooms in Indonesian junior high schools remains underexamined. This qualitative descriptive-exploratory study investigated English teachers' perceptions of, and students' experiences with, coding literacy integration at a public junior high school in Tanjung Morawa, North Sumatra. Data were collected through semi-structured interviews with two English teachers and a questionnaire administered to seventeen seventh-grade students who participated in an English-medium, coding-based learning activity. Data were analyzed using the Miles, Huberman, and Saldaña model of data condensation, display, and conclusion drawing. Findings show that teachers perceived the activity as fostering strong student engagement, expanding instructional vocabulary, and prompting early signs of computational thinking, while framing English itself as a natural bridge into coding because programming languages and interfaces are predominantly English-medium. Students reported near-unanimous enjoyment, motivation, and a sense of achievement, alongside a more uneven picture of instructional comprehension, in which a meaningful minority experienced confusion despite persisting independently rather than disengaging. These findings suggest that coding-integrated English learning cultivates authentic, purposeful language use and rudimentary computational reasoning simultaneously, even as it exposes uneven readiness in reading English instructions. The study contributes an empirically grounded account of how coding literacy and language development mutually reinforce one another in an under-researched Southeast Asian secondary setting and offers implications for EFL pedagogy, teacher preparation, and curriculum design.

Keywords: coding literacy, computational thinking, EFL learning, teacher perception, student experience, junior high school

Introduction

The competencies expected of twenty-first-century learners have shifted decisively toward computational thinking, a mode of reasoning once confined to computer science but now widely treated as a transferable literacy on par with reading and numeracy (Wing, 2006). This reframing has been echoed in compulsory-education policy discussions that call for computational thinking to be woven into general curricula rather than isolated in specialized tracks (Voogt et al., 2015). In many education systems, this has translated into deliberate curricular integration; in Indonesia, however, and particularly at the junior high school level, coding-related activity in mainstream subjects

remains sporadic, dependent on individual teacher initiative rather than systematic policy, and rarely examined through sustained academic inquiry.

English occupies a distinctive position within this landscape. The interfaces, instructions, and community documentation of the coding platforms most commonly used in school settings, including Scratch, Tynker, and code.org, are predominantly English-medium. This is not incidental: it means that when Indonesian junior high school students engage with coding activities, they are simultaneously engaging with English as the operational language through which tasks are understood and completed, not merely as a subject to be studied. Such conditions create a naturally occurring, task-based context for authentic English use, one that mirrors long-standing arguments in the technology-enhanced language learning literature that a target language is most powerfully acquired when it functions as the medium of a meaningful task rather than as an object of instruction in itself (Warschauer & Kern, 2000).

A growing body of international research supports the view that integrating digital technology into foreign language instruction benefits motivation, engagement, and achievement (Warschauer & Kern, 2000), and studies that pair computational thinking activities with EFL instruction through game-based platforms report similarly reinforcing gains across both domains (Hsu et al., 2023). Reviews of computational thinking within English-language curricula likewise indicate that language and computational skills can develop in tandem when tasks are deliberately designed to require both (Li et al., 2024). Yet this literature is overwhelmingly situated outside Southeast Asia, and studies that examine coding literacy integration specifically, rather than educational technology use in general, within Indonesian EFL classrooms remain scarce (Dewi et al., 2025). Two gaps are particularly pressing within this scarcity. First, teachers' perceptions of coding integration, its relevance, its challenges, and its place within EFL pedagogy, are seldom documented in the Indonesian context, despite teachers being widely recognized as the decisive agents determining whether an educational innovation is adopted authentically or merely performed for compliance (Fullan, 2007). Second, students' own experiences of learning English through coding, how they make sense of the activity, whether it feels motivating or confusing, and what it reveals about their emerging computational reasoning, remain largely undocumented from a qualitative, participant-centered perspective (Delal, 2022).

The present study addresses both gaps through a single qualitative inquiry conducted at SMP Negeri 2 Tanjung Morawa, a public junior high school in North Sumatra that had recently introduced an English-medium, coding-based learning activity into its instructional practice. Two research questions guided the study:

1. How do English teachers perceive the potential, challenges, and relevance of integrating coding literacy into EFL learning at the junior high school level?
2. How do students experience English learning integrated with coding literacy activities, particularly regarding language development and computational thinking?

By triangulating teachers' interview accounts with students' questionnaire responses, this study aims to build an interpretive, theme-based understanding of how coding literacy integration is perceived and lived in an Indonesian EFL classroom, contributing both to the still-limited empirical record on this topic and to practical considerations for teachers and curriculum developers navigating similar innovations.

Coding literacy refers to the capacity to read, write, and reason with the logical structures underlying programming, a competency increasingly regarded as foundational rather than specialized (Kafai & Burke, 2014). Its cognitive core is what Wing (2006)

termed computational thinking: the ability to formulate problems and solutions in forms that can be carried out systematically, involving abstraction, decomposition, pattern recognition, and algorithmic reasoning. Subsequent scholarship has cautioned against treating computational thinking as a single, easily measured skill, arguing instead that it surfaces unevenly across tasks and is best understood as a developing competency rather than a fixed trait (Tikva & Tabak, 2022). This distinction matters for classroom-based research: rather than asking whether learners "have" computational thinking, it is more productive to ask where and how signs of it emerge within a given activity, which is the approach adopted in the present study.

Within the broader field of technology-enhanced language learning, coding-based activities occupy a distinctive niche because the target language is not simply delivered through a digital tool but functions as the operational interface through which the tool is used (Warschauer & Kern, 2000). Learners must read instructions accurately enough to act on them, which positions comprehension as a precondition for task success rather than an end in itself. This dual function, language as both medium and object of learning, has been shown to sustain both linguistic engagement and computational reasoning simultaneously when tasks integrating the two are deliberately designed (Hsu et al., 2023). It is this dual function that the present study examines from the perspectives of the teachers who designed and facilitated the activity and the students who lived through it.

Teachers are widely recognized as the pivotal agents in determining whether an educational innovation becomes embedded practice or remains a superficial add-on (Fullan, 2007), a dynamic consistent with classic accounts of how innovations diffuse through social systems via the interpretation and endorsement of key adopters (Rogers, 2003). Teachers' willingness to sustain a technology-integrated practice is shaped not only by perceived benefit but by their confidence in handling the technology itself, a confidence that research on technological pedagogical content knowledge suggests is unevenly distributed and closely tied to self-efficacy (Dong et al., 2020). Qualitative accounts of teachers integrating coding into language instruction elsewhere have found that teachers tend to frame the innovation in pedagogical rather than purely technical terms, valuing it for the opportunities it creates for authentic language use and student engagement (Delal, 2022). The present study extends this line of inquiry to an Indonesian junior high school context in which such teacher perspectives have not previously been documented.

Meaningful learning theory holds that new knowledge is retained and transferred more effectively when it is anchored in tasks that learners experience as purposeful and connected to real outcomes, a principle closely aligned with sociocultural accounts of learning as a socially mediated, task-embedded process (Vygotsky, 1978). Coding activities, by requiring learners to act on instructions to achieve a visible, immediate outcome such as completing a puzzle or advancing a level, offer precisely this kind of purposeful task structure. Prior classroom-based research on coding-integrated EFL activities has found that students who complete coding tasks largely independently, seeking help only when necessary, display a form of learner autonomy consistent with broader theorizing on self-directed language learning (Little, 1991), while their step-by-step task completion itself constitutes an observable, early indicator of computational thinking. Reviews of integrated STEM instruction similarly emphasize that cross-disciplinary tasks of this kind support engagement precisely because they resist being reduced to a single subject-area skill (Thibaut et al., 2018). Framing coding as a form of purposeful, playful engagement further underscores why such activities can feel

motivating rather than burdensome to young learners (Bers, 2018). The present study builds on this foundation by examining, through participants' own words and self-reports, how these dynamics of purposefulness, comprehension, and independence played out for a specific group of teachers and students.

Method

Research Design

This study employed a qualitative descriptive-exploratory design, appropriate for capturing the "how" and "why" of an emerging pedagogical practice for which no standardized instrument yet exists (Creswell & Poth, 2018). Rather than testing a predetermined model, the design allowed themes concerning teachers' perceptions and students' experiences to be built inductively from participants' own accounts.

Research Setting and Participants

The study was conducted at SMP Negeri 2 Tanjung Morawa, a public junior high school in a semi-urban district of North Sumatra, Indonesia, as part of a broader research project examining the integration of coding literacy into English language instruction at the school. The school was selected because it had already introduced an English-medium, coding-based learning game into classroom practice and possessed the computer laboratory infrastructure needed to sustain such activity.

Participants comprised two English teachers, Maria Magdalena and Evi Yusmiati Purba, who had directly facilitated the coding-integrated learning activity, and seventeen seventh-grade students ($n = 17$) who had participated in it. Teachers were purposively selected as key informants with first-hand pedagogical insight into the activity's implementation, while the student sample represented the full cohort involved in the sessions from which questionnaire data were drawn.

Instruments and Data Collection

Two primary instruments were used. Semi-structured interviews were conducted individually with each teacher, using five guiding questions addressing student engagement, the activity's contribution to understanding English instructions, perceived development in speaking and reading skills, evidence of computational thinking such as sequencing steps, problem-solving, or retrying after failure, and teachers' overall assessment of the learning experience. Interviews were recorded, transcribed, and, where originally conducted in Indonesian, translated into English for analysis.

A structured questionnaire was administered to the seventeen participating students to capture their self-reported experience of the activity across ten items using a binary yes/no response format, covering enjoyment, perceived interest of the activity, ease of understanding instructions, vocabulary gains, motivation, ease of gameplay, instances of confusion when reading instructions, independent effort to understand instructions, satisfaction upon completing levels, and overall enjoyment of learning through the game. Consistent with the study's qualitative orientation, questionnaire results were treated not as a standalone quantitative outcome but as corroborating and complicating evidence to be read alongside the interview data, following recommendations that quantitative counts in qualitative designs are most useful when they sharpen rather than replace interpretive analysis (Creswell & Poth, 2018).

Data Analysis

Data were analyzed using the model developed by Miles, Huberman, and Saldaña (2014), comprising three interrelated stages: data condensation, in which interview transcripts and questionnaire responses were reduced and organized around the study's two research questions; data display, in which condensed data were arranged into thematic matrices contrasting teacher and student perspectives; and conclusion drawing and verification, in which emerging themes were checked against the full data corpus for consistency before being finalized. Coding proceeded from open coding of raw responses toward more selective, theoretically informed categories aligned with computational thinking, language comprehension, engagement, and autonomy.

Trustworthiness

Trustworthiness was addressed through triangulation of sources, cross-reading teachers' qualitative accounts against students' self-reported questionnaire patterns to identify points of convergence and divergence, consistent with naturalistic inquiry's emphasis on multiple data sources as a safeguard against interpretive bias (Lincoln & Guba, 1985). Direct, minimally edited translation of participants' responses was maintained wherever possible to preserve the authenticity of their voices, and interpretive claims in the Results and Discussion sections were kept traceable to specific data excerpts rather than presented as free-standing generalizations.

Results

Teachers' Perspectives on Coding Literacy Integration (RQ1) Perceived Student Engagement

Both teachers independently described the coding-based English activity as generating unusually high levels of student enthusiasm. Maria Magdalena observed that "students were highly enthusiastic about this English-language, coding-based game," while Evi Yusmiati Purba similarly noted that "students were very enthusiastic throughout the learning process." That two teachers working with different groups converged on the same descriptor, enthusiasm, without prompting from a shared script, suggests that heightened engagement was not an artifact of novelty experienced by a single class but a more general feature of how the activity was received across the cohort. This convergence is consistent with prior findings that game-based, technology-mediated language activities tend to elevate engagement relative to conventional instruction (Warschauer & Kern, 2000).

Vocabulary and Instructional Comprehension

Both teachers linked the activity directly to gains in students' comprehension of English instructions, though they emphasized this in slightly different terms. Maria Magdalena reported that the activity "greatly helped students improve their vocabulary related to instructions in English," pointing specifically to instructional vocabulary rather than general vocabulary, a distinction that matters because it locates the vocabulary gain precisely where the coding task demanded it: in the language students needed to act correctly within the game. Evi Yusmiati Purba's response was more general but affirmed the same direction, describing the activity as simply "very helpful" for instructional comprehension. This theme positions the coding activity not as incidental exposure to English but as a task environment that made specific, functional vocabulary indispensable to success.

Speaking, Reading, and the Discovery That "English Is Everywhere in Code"

Both teachers reported perceived improvement in students' speaking or reading skills, but attributed this improvement to different underlying mechanisms. Maria Magdalena connected the improvement to a shift in attitude, noting that "speaking and reading skills improved because learning English turned out to be interesting to them," and went further to observe that the overall learning experience improved "because computer languages, it turns out, also use English." This latter comment is analytically significant: it suggests that the teacher perceived the coding activity as doing more than motivating students to practice English, it appeared to reframe English itself in students' eyes, from a subject confined to the classroom to a language with visible utility in the technological world outside it. Evi Yusmiati Purba's account was narrower in scope, indicating that "reading skills could improve" without extending the claim to speaking, suggesting that among the two teachers' observations, reading comprehension was the more consistently and confidently reported gain, while speaking development was less uniformly observed.

Emerging Computational Thinking

Both teachers reported observing behavior consistent with computational thinking during the coding sessions, though their descriptions again varied in specificity. Maria Magdalena linked this to a general shift toward critical thinking, stating that evidence was "visible in how they began to think critically." Evi Yusmiati Purba offered a more structurally precise account, affirming that computational thinking was evident "because every activity led toward computational thinking ability," implying that she read the task design itself, rather than isolated student behaviors, as the source of this cognitive engagement. Read together, these accounts suggest that teachers perceived computational thinking not as a separate skill bolted onto the language activity but as something the activity's structure made almost unavoidable to practice.

Overall Assessment

Both teachers offered unreservedly positive overall assessments, describing the learning experience as having "improved" and as "very interesting and beneficial," respectively. Notably, neither teacher, across five guiding questions that explicitly invited reflection on relevance and effects, spontaneously raised implementation challenges, resource constraints, or reservations. This absence is itself a finding worth noting rather than a gap to be explained away; it is addressed further in the Discussion.

Students' Learning Experiences with Coding-Integrated English Activities (RQ2)

Students' self-reported experiences were captured through a ten-item questionnaire ($n = 17$), presented below in three parts corresponding to the instrument's thematic groupings. Each chart is followed by an interpretation of what the pattern of responses suggests about students' experience of the activity.

Part 1: Enjoyment, Interest, and Vocabulary

Student Questionnaire Results (Part 1): Enjoyment, Interest, and Vocabulary (n = 17)

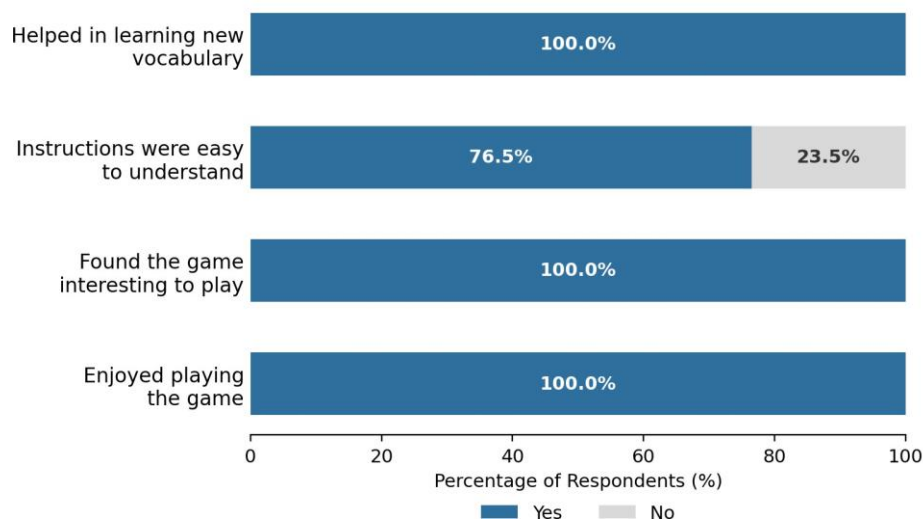


Figure 1. Student Questionnaire Results (Part 1): Enjoyment, Interest, and Vocabulary (n = 17)

Students' self-reported enjoyment of the activity was unanimous on three of the four items in this group. All seventeen respondents (100%) indicated that they enjoyed playing the game, that they found the game interesting to play, and that it helped them learn new vocabulary. The fourth item introduces the first point of variation in the dataset: only 76.47% of students found the instructions easy to understand, leaving nearly a quarter of respondents (23.53%) for whom the instructional language was not straightforwardly accessible. This early divergence is instructive: it shows that positive affect toward the activity as a whole did not automatically extend to every component of it, and specifically singles out the English instructions, rather than the game or the vocabulary content, as the point where some students' experience became more effortful.

Part 2: Motivation, Playability, and Confusion

Student Questionnaire Results (Part 2): Motivation, Playability, and Confusion (n = 17)

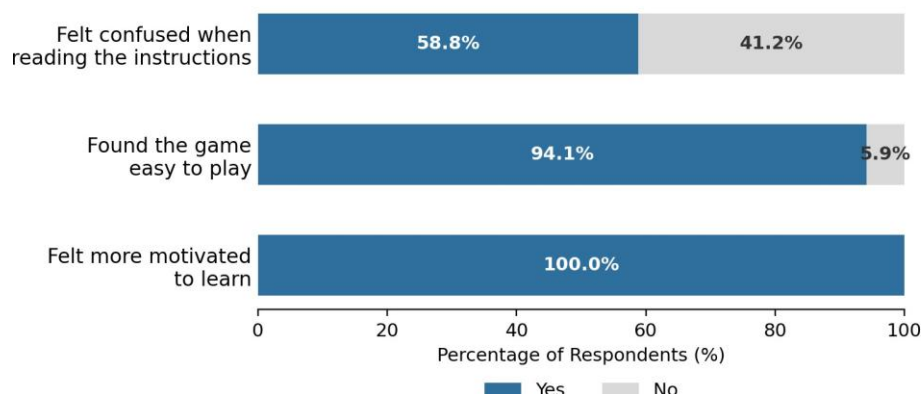


Figure 2. Student Questionnaire Results (Part 2): Motivation, Playability, and Confusion (n = 17)

This second set of items sharpens the pattern identified above. All students (100%) reported feeling more motivated to learn, and nearly all (94.12%) found the game easy to

play, again indicating that the game mechanics themselves posed little difficulty. However, when asked directly whether they had felt confused while reading the instructions, a majority of students (58.82%) said yes, against 41.18% who did not. Read alongside the 76.47% who had earlier reported that instructions were easy to understand overall, this item suggests that even students who judged the instructions manageable in general still experienced moments of confusion in practice. Taken together, these figures indicate that gameplay mechanics were more uniformly accessible to students than the English text that governed them, a distinction that becomes especially meaningful set against the results reported next.

Part 3: Independence and Enjoyment

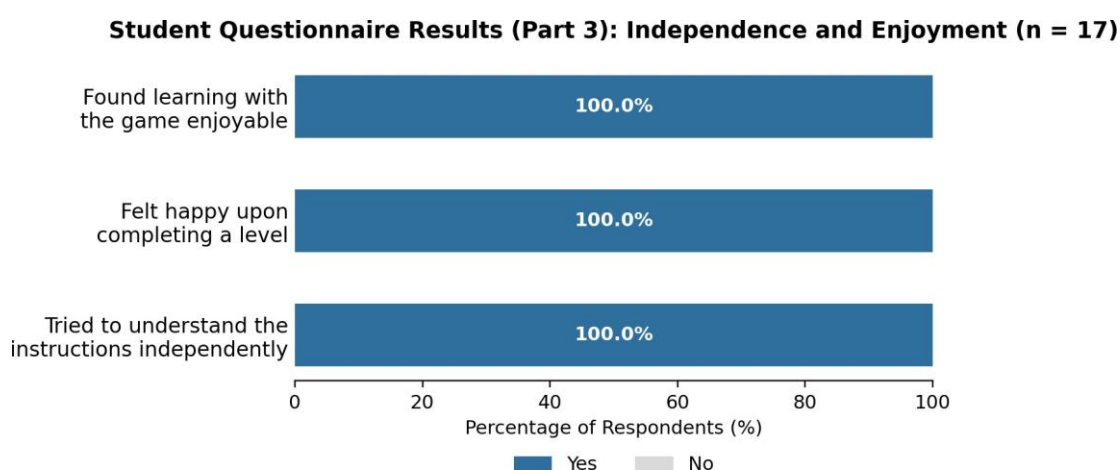


Figure 3. Student Questionnaire Results (Part 3): Independence and Enjoyment (n = 17)

Despite the comprehension difficulty reported above, all students (100%) indicated that they tried to understand the instructions on their own, all (100%) reported feeling happy upon successfully completing a level, and all (100%) described learning with the game as enjoyable. This is a notable pairing: a majority of students experienced confusion while reading English instructions at some point, yet the entire sample nonetheless reported attempting independent comprehension rather than disengaging or relying exclusively on external help. The co-occurrence of reported confusion and unanimous self-directed effort suggests that difficulty with the instructional language did not translate into avoidance; instead, students appear to have treated comprehension of the English text as a problem to be worked through rather than a barrier that stopped the activity.

Synthesis Across Themes

Taken together, the three parts of the questionnaire depict a learning experience in which affective response, enjoyment, interest, motivation, and satisfaction, was close to universally positive, while the linguistic dimension of the task, understanding written English instructions, was more variable, generating genuine difficulty for a meaningful minority of students without deterring their engagement. This pattern converges with, and adds nuance to, the teachers' more uniformly positive framing: where teachers emphasized vocabulary and comprehension gains as an outcome of the activity, students' self-reports suggest that comprehension was, for some, a real and only partially resolved challenge along the way, one they nonetheless worked through rather than around.

Discussion

Why the Findings Occurred: Reframing English as a Functional Language

The teachers' descriptions of English as the language "computer languages also use" point to a plausible explanation for the near-unanimous engagement students reported: the coding activity did not simply add a game to English lessons, it repositioned English itself as a language with visible, external utility. This aligns with the long-standing argument that a target language is most powerfully engaged when it operates as the medium through which a meaningful task is accomplished rather than as an isolated object of study (Warschauer & Kern, 2000). Where conventional EFL instruction can position English primarily as a school subject to be mastered for assessment, the coding activity positioned it as the operational key to a desirable outcome, completing a level, solving a puzzle, that students visibly wanted to reach. This reframing offers a more specific mechanism than "motivation" alone for why enjoyment and interest were reported so uniformly across the student sample.

The Gap Between Enjoyment and Comprehension

The coexistence of near-universal enjoyment with a meaningful minority of students reporting confusion when reading instructions warrants closer interpretation than a simple report of percentages would allow. One plausible reading is that the game's non-linguistic affordances, visual feedback, trial and error, and immediate consequences of actions, allowed students to progress and feel successful even when their comprehension of the accompanying English text was incomplete. This would be consistent with the observation that a smaller share of students found the game easy to play than found it enjoyable, and with the finding that essentially all students, whether or not they experienced confusion, reported trying to work through the instructions independently rather than stalling. In other words, the activity appears to have created enough redundancy between visual and linguistic cues that partial comprehension did not equate to task failure, while still requiring enough genuine reading effort that instructional vocabulary, as the teachers separately reported, became something students had reason to notice and learn. This reading is compatible with prior work suggesting that computational thinking and language comprehension can develop in tandem specifically because well-designed coding tasks require both without making either an absolute precondition for progress (Li et al., 2024).

Independent Persistence as an Early Marker of Computational Thinking

The finding that all students attempted to understand instructions independently, even amid reported confusion, is itself interpretable as an early behavioral marker of computational thinking rather than merely a motivational one. Persisting through an ambiguous instruction, retrying interpretation, and adjusting one's approach until a workable understanding is reached mirrors the iterative, error-tolerant reasoning that Wing (2006) identifies as central to computational thinking, and echoes teachers' own observations that computational thinking was visible in how students "began to think critically" and in how the activity's structure made such thinking difficult to avoid. This convergence between what students reported doing and what teachers reported observing strengthens the interpretive claim that computational reasoning and language comprehension were not parallel but entangled processes in this activity: working out

what an English instruction meant was, functionally, a small computational problem in its own right, requiring students to decompose an unfamiliar

sentence, test an interpretation by acting on it, and revise if the outcome did not match the goal.

Teachers as Enthusiastic but Understated Reporters of Challenge

The absence of spontaneously reported challenges in the teacher interviews stands in some tension with the more mixed picture that emerged from student data, and this tension is itself worth examining rather than smoothing over. It may reflect a genuine absence of major implementation obstacles at this early stage of adoption, consistent with accounts describing early-adopting teachers as particularly favorably disposed toward an innovation they have chosen to take up (Rogers, 2003). It may also reflect the brevity of the interview format used, five direct questions oriented toward benefits rather than open invitations to critique, or a degree of understandable reluctance to characterize a new practice unfavorably when discussing it as facilitators rather than external evaluators. Regardless of cause, the practical implication is the same: teacher-reported enthusiasm, however genuine, should not be read as evidence that the activity is challenge-free, since a meaningful minority of the students those same teachers were describing as thriving also reported real difficulty with the instructional language. This is consistent with research indicating that even highly motivated adopters of educational technology may under-report friction where their own confidence with the technology, rather than the technology's actual demands on learners, becomes the implicit frame of reference (Dong et al., 2020).

Implications for ELT Pedagogy and Teacher Preparation

For EFL pedagogy, these findings suggest that coding-integrated activities can generate authentic, purposeful engagement with English while simultaneously exercising computational reasoning, but that this benefit is not automatically evenly distributed across a class. Teachers seeking to adopt similar activities may benefit from building in light-touch comprehension checks or paired support specifically targeted at instructional language, not to abandon the productive struggle that appears to support both language and computational gains, but to ensure that struggle remains generative rather than becoming, for some students, a source of quiet disengagement invisible to a teacher focused on overall class enthusiasm. This is consistent with calls for integrated, cross-disciplinary task design that resists reduction to a single subject-area skill while still attending to each discipline's distinct demands (Thibaut et al., 2018). For teacher preparation and professional development, the pattern of confident but circumscribed pedagogical framing observed here, teachers speaking fluently about engagement and vocabulary but not about differentiated comprehension needs, points to a specific area where structured reflection or peer observation focused on lower-visibility student struggles could strengthen how coding-integrated activities are facilitated going forward, complementing existing evidence that teachers' technological confidence shapes how they perceive and respond to student needs during innovation adoption (Dong et al., 2020).

Conclusion

This study examined how English teachers perceived, and how students experienced, the integration of coding literacy into EFL learning at an Indonesian junior

high school. Teachers described the activity in consistently positive terms, emphasizing heightened student engagement, gains in instructional vocabulary, and emerging signs of computational thinking, while notably reframing English itself as a language with tangible utility beyond the classroom. Students' self-reports corroborated this positive engagement almost unanimously, yet also revealed a more uneven experience of instructional comprehension, one that a meaningful minority worked through independently rather than one that was resolved for the whole cohort. Read together, these findings support a view of coding-integrated English learning as an activity in which authentic language use and computational reasoning develop in tandem, each drawing on and reinforcing the other, rather than as two separate outcomes that happen to co-occur. Theoretically, this study extends existing accounts of coding-integrated EFL learning by demonstrating, through paired teacher and student data, that positive overall engagement and uneven linguistic comprehension are not contradictory findings but complementary facets of the same activity, a nuance that aggregate or single-informant designs risk missing. Pedagogically, the findings suggest that teachers introducing similar activities should treat enthusiastic engagement as compatible with, rather than evidence against, targeted comprehension support, and that professional development for coding-integrated ELT may benefit from explicitly addressing how to notice comprehension difficulty that is not accompanied by visible disengagement.

This study is limited by its small, single-school sample of two teachers and seventeen students, and by its reliance on binary questionnaire items and retrospective interview accounts rather than close, process-level observation of comprehension difficulty as it unfolded. Future research would benefit from combining this kind of stakeholder self-report with structured, in-the-moment observation of how individual students negotiate instructional confusion during coding tasks, as well as from extending this line of inquiry across a larger number of schools and teachers to examine whether the patterns identified here, particularly the gap between reported enjoyment and reported comprehension, recur in other Indonesian EFL contexts.

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