

# An Accompaniment-Oriented Human–Machine Collaborative Model for EFL Writing Assessment

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**Abstract**—This study constructs and implements an accompaniment-oriented human–machine collaborative model for EFL writing assessment, which integrates both process-oriented and product-oriented assessment through the use of technological tools. The model further clarifies the respective roles of teacher assessment, self-assessment, peer assessment, and machine assessment, thereby establishing a comprehensive and systematic framework for EFL writing evaluation. By incorporating the evaluation of EFL writing learning strategies, EFL writing strategies, and EFL writing outcomes, the model extends beyond existing studies in terms of scope, diversity of assessors, and richness of methods. Moreover, it combines multiple complementary approaches—including questionnaires, think-aloud protocols, keystroke logging, screen-recording software, corpus-based data analysis, and multi-faceted Rasch modeling—to provide triangulated evidence, thereby enhancing the overall reliability of the proposed assessment model.

**Index Terms**—accompaniment-oriented, human–machine collaborative model, EFL writing assessment

## I. INTRODUCTION

Contemporary educational assessment activities primarily revolve around three core questions: why assess, what to assess, and how to assess. With increasing research on the relationship between learning and assessment in the field of EFL teaching, the principles of assessment for learning, assessment for teaching, and the integrated model of assessment as learning and teaching have gradually become the dominant paradigm in EFL learning assessment (Cheng, 2023). This paradigm holds that assessment is not only a means of measuring learning outcomes but also a learning strategy in itself, forming an integral part of the learning process. Therefore, effective learning assessment must cover the entire learning process.

In the late 1970s, in response to the limitations of the traditional product approach to writing instruction, Flower and Hayes (1981) proposed the process approach. They argued that writing is both a complex cognitive process and a communicative act, and therefore writing courses should focus on teaching the step-by-step procedures that constitute the writing process. With the shift in pedagogical paradigms in EFL writing instruction, writing assessment has also moved from a traditional, product-oriented model to a more comprehensive model that integrates both product and process evaluation.

In October 2020, the State Council of China issued the Overall Plan for Deepening the Reform of Education Evaluation in the New Era (The State Council, 2020), emphasizing that educational assessment should be more scientific and effective, improve outcome-based evaluation, strengthen process-based evaluation, explore value-added evaluation, and establish comprehensive evaluation. The plan also highlights the full use of information technology to enhance the scientific rigor, professionalism, and objectivity of educational assessment.

Against the broader backdrop of nationwide promotion of educational informatization, it is of both practical and theoretical significance to explore how information technology can be deeply integrated with EFL writing assessment, and how the complementary strengths of human assessment and machine assessment can be coordinated to jointly promote the development of EFL writing competence.

## II. LITERATURE REVIEW

### A. Why Assess

To enhance teaching effectiveness and learning outcomes, educational policymakers worldwide have called on frontline teachers to integrate assessment throughout the whole teaching process, so as to support, monitor, guide, and promote student learning (Fulcher, 2012; DeLuca & Johnson, 2017; Lin & Wu, 2014). Whole-process assessment

emphasizes that teachers, through interventions or interactions with learners during assessment, observe learners' progress and changes, aiming fundamentally to unlock learning potential and promote developmental abilities. It represents a genuinely future-oriented, learning-promoting form of assessment that benefits both the current situation and long-term growth (Liu & Li, 2020).

Black and Wiliam (2009) argue that formative assessment involves continuously monitoring and evaluating students' learning during the teaching process according to certain standards, and carefully interpreting and analyzing the assessment results in order to provide timely, rich, and targeted feedback for both teaching and learning, ultimately aiming to enhance learning. They contend that formative assessment is not merely an assessment method but should also be regarded as a teaching philosophy (Black & Wiliam, 2009). In EFL writing instruction, both teachers and learners can make decisions about subsequent actions based on formative assessment results. Teachers can adjust instructional content and pacing accordingly, provide diagnostic analysis of students' writing competence, and help students understand their strengths and weaknesses, thereby producing a feedback loop effect. Therefore, the ultimate goal of EFL writing assessment is to generate a positive feedback effect on both teaching and students' autonomous learning (He, 2020).

### *B. What to Assess*

In 2018, the Ministry of Education of China issued the China Standards of English Language Ability (CSE), which, based on social-cognitive theory and communicative competence theory, defines writing competence as the ability to generate, construct, or integrate meaning by employing knowledge of composition, pragmatics, and text types, as well as writing strategies, in order to achieve written communication goals for specific audiences in specific contexts (Liu, 2018). Based on this construct, the CSE writing scale delineates writing competence from two perspectives: textual features (product) and writing strategies (process). The scale systematically and objectively describes writing abilities at different levels according to various writing functions, purposes, and contexts—such as written description, narration, exposition, instruction, argumentation, and interactive writing—as well as specific writing strategies, including planning (ideation), execution (drafting), and evaluation/remediation (revision) (Deng, 2022). The CSE's conceptualization of writing competence thus provides a theoretical foundation for a “product + process” assessment model.

Currently, however, the “process” component in the CSE writing scale only concerns the completion process of individual writing tasks. From a more comprehensive perspective, EFL writing assessment should also consider the writing learning process, which includes metacognitive strategies, cognitive strategies, affective strategies, and communicative strategies—for example, knowledge of the subject matter, task knowledge, training plans, methods, regulation and evaluation, writing anxiety, self-efficacy, and interactive learning. Existing research on EFL writing assessment, however, has paid insufficient attention to these aspects.

### *C. How to Assess*

The question of how to assess relates to the observability of the measurement targets. For reasons of observability, parameters of the writing process can be incorporated into writing strategies, while parameters of the product can be incorporated into textual features, which reflect the concrete application of language knowledge (Lu, 2016).

In the product-based writing approach, the primary assessor is the teacher, and the assessment targets a limited number of student writing samples. This model requires substantial teacher effort, which is often impractical for most university writing instructors given the current educational environment. The use of Automated Writing Evaluation (AWE) systems greatly alleviates the workload associated with grading large volumes of essays. Furthermore, its interactive EFL writing practice assessment and revising functions help students develop autonomous learning skills, and foster a habit of repeated revisions. Additionally, the electronic writing portfolios embedded in the AWE systems can serve as evidence for formative assessment, documenting the development of writing competence (Liu, 2018). However, existing AWE systems remain severely limited in evaluating organizational structure, content depth, textual cohesion, genre style, and critical thinking skills, which still rely primarily on human assessment (Li, 2017).

In the assessment of the EFL writing learning process, with the increasing application of AWE systems, online teaching platforms, writing process-tracking tools, and text analysis systems in EFL writing instruction, various teaching and learning data can now be deeply mined and analyzed from multiple dimensions. Continuous assessment and feedback can fulfill guiding and motivational functions, shifting classroom evaluation from a static, stage-based model to a dynamic, full-process approach (Wang, 2020). Technological support makes accompaniment-oriented assessment possible, allowing the continuous tracking of the learning process and dynamic evaluation throughout. This approach emphasizes the timely collection and analysis of learning process data, highlighting the role of data in guiding instruction and supporting autonomous learning.

From a practical perspective, repeatedly collected grades are often insufficient for fully understanding students' developmental trajectories; self-reported classroom performance data may lack validity and objectivity; and periodic assignment and test data are limited in their ability to dynamically locate and track student progress. Consequently, single-type data, untimely feedback, and detachment from instructional contexts remain major challenges in educational assessment.

In the assessment of the writing process, with the transition from traditional paper-and-pen writing to computer-based writing, keystroke logging software (e.g., Trace-it, Inputlog, Scriptlog, Translog) and screen recording software (e.g., Camtasia, Screen CAP) can record and analyze the EFL writing process in real time. Teachers can leverage these technologies to observe and evaluate students' writing processes, yet both the practical application and research on such assessment methods remain underdeveloped (Xu, 2011; Wang, 2020).

From what's reviewed above, existing EFL writing assessment research has primarily focused on textual features and the quality of writing, paying insufficient attention to the evaluation of EFL writing strategies and EFL writing learning strategies. Relying solely on textual feature analysis neither provides a comprehensive and objective understanding of learners' English writing competence nor facilitates the timely and effective identification and resolution of problems arising during the writing process. Writing, in essence, reflects the author's cognitive processes, and both the writing environment and the nature and difficulty of the writing task substantially influence performance. Therefore, focusing on learners' writing processes and writing learning processes is conducive to identifying the root causes of problems from cognitive, social-interactive, and communicative perspectives, thereby informing the development of effective writing strategies.

### III. AN ACCOMPANIMENT-ORIENTED HUMAN-MACHINE COLLABORATIVE MODEL FOR EFL WRITING ASSESSMENT

From the perspective of current assessors and assessing tools, relying exclusively on human assessment or machine assessment is insufficient to capture writing strategies and learning strategies, as these are closely related to learners' cognitive processes, which cannot be directly observed and can only be inferred through learners' external and typical learning activities. To ensure validity and reliability, it is necessary to leverage available technological tools and integrate the complementary strengths of human and machine assessment. This integrated approach should comprehensively address the writing product, the writing process, and the writing learning process, thereby establishing an accompaniment-oriented human-machine collaborative EFL writing assessment model.

In the context of digital and intelligent-enhanced EFL writing learning, accompaniment-oriented human-machine collaborative EFL writing assessment model demonstrates three key characteristics: it spans the entire learning domain, covers the whole learning process, and supports individual adaptive learning. Accompaniment-oriented assessment enables timely evaluation of students' learning status and outcomes, providing targeted feedback and interventions. Assessment content is designed specifically for knowledge mastery, problem-solving, and attitudinal development, thereby enriching the scope of traditional assessment methods (Yang et al., 2017).

From the perspective of EFL writing instruction, the core of an accompaniment-oriented human-machine collaborative assessment model lies in using supportive tools to collect data throughout the entire writing classroom process. These learning data are analyzed and evaluated in real time, and the results are immediately fed back to inform teaching, providing timely and targeted feedback and interventions. This dynamic approach allows for continuous monitoring of students' EFL writing development and the adjustment of instructional strategies accordingly.

The accompaniment-oriented assessment is an approach that tracks the continuous learning process and conducts a dynamic, whole-process evaluation. It advocates the timely collection and analysis of learning process data, emphasizing the guiding and feedback functions of the data for both instruction and autonomous learning (Wang, 2020). With the increasing application of online teaching platforms, Automated Writing Evaluation (AWE) systems, writing process-tracking tools, and text analysis systems in EFL writing instruction, the human-machine collaborative accompaniment-oriented assessment model can deeply explore and analyze multiple types of instructional data, transforming EFL writing assessment from a static, stage-based evaluation into a dynamic, whole-process evaluation. The model is designed as follows:

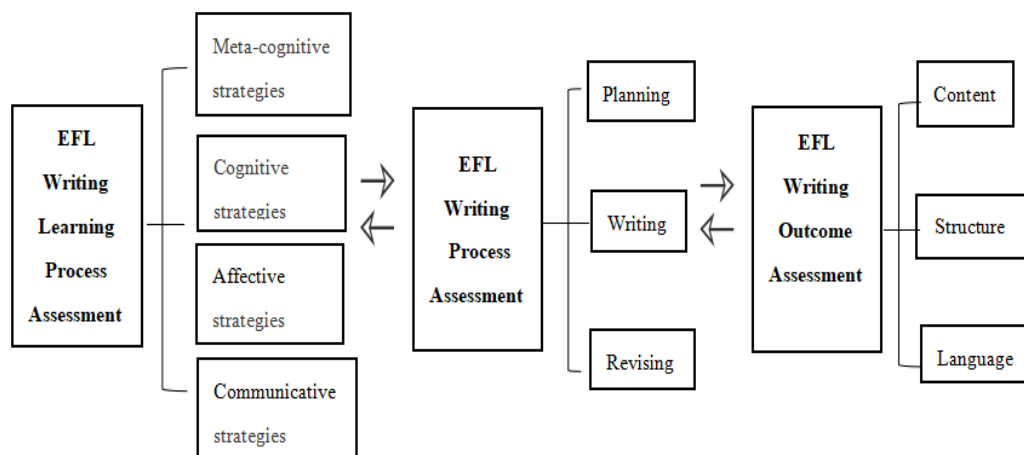


Figure 1. An Accompaniment-Oriented Human-Machine Collaborative Model for EFL Writing Assessment

#### IV. THE APPLICATION OF ACCOMPANIMENT-ORIENTED HUMAN–MACHINE COLLABORATIVE MODEL FOR EFL WRITING ASSESSMENT

The application of accompaniment-oriented human-machine collaborative assessment model in EFL writing requires the full integration of process-based and product-based evaluations using technological tools, and a clear delineation of the roles of teacher assessment, self-assessment, peer assessment, and machine assessment, so as to establish a comprehensive and scientifically grounded EFL writing assessment system. By investigating students' use of EFL writing learning strategies, writing strategies, and their writing quality data, we can examine the impact of this accompaniment-oriented assessment on students' EFL writing competence. The specific implementation plan is shown in Table 1.

TABLE 1  
THE SPECIFIC IMPLEMENTATION PLAN

Dimension	EFL Writing Learning Process Assessment	EFL Writing Process Assessment	EFL Writing Product Assessment
Assessment Content	Metacognitive strategies Cognitive strategies Affective strategies Communication strategies	Selective attention Planning Drafting Reflection and revision	Content relevance Structural coherence Lexical complexity Syntactic complexity
Assessment Tools	Course platform system; EFL writing learning strategy scale; Classroom observation checklist	Keystroke logging & screen recording system; CSE English Writing Competence Scale; EFL writing reflection log	Automated Writing Evaluation (AWE) system; L2SCA & LCA; CSE English Writing Competence Scale; Writing scoring standards of authoritative English exams
Assessment Data	Learner characteristic data; Resource utilization data; Discussion & interaction data; In-class test data; Student affective data; Class management data	EFL writing process data; EFL writing psychological state data	EFL essay revision process data; Essay quality data; Essay error analysis data; Essay syntactic & lexical complexity data
Assessors	Mainly self-assessment, teacher assessment as supplementary	Mainly self-assessment, teacher assessment as supplementary	<b>Content &amp; structure:</b> Mainly teacher assessment, self-assessment and peer assessment; machine assessment as supplementary. <b>Language:</b> Mainly machine assessment, self-assessment and peer assessment; teacher assessment as supplementary
Use of Assessment Results	Holistic learning situation analysis; individual differences analysis; Differentiated teaching design	Problems identified via reflective questioning; Exemplary case-based teaching; Autonomous learning improvement	Scientific writing assessment Diagnostic feedback Dynamic teaching adjustment

##### A. Beginning of the Semester

The accompaniment-oriented EFL writing assessment model is first constructed, and participating teachers and students are trained. A writing learning strategy questionnaire is designed to investigate students' use of learning strategies from both metacognitive and cognitive perspectives. Metacognitive strategies in EFL writing include planning, regulation, and evaluation of writing training, such as learning styles, learning attitudes, and self-assessment of existing writing competence. Cognitive strategies involve activities such as model essay analysis, memorization of model texts, imitation writing, post-reading continuation, and lexical chunk memory and retrieval training. Students' knowledge related to writing tasks is also assessed, including genre knowledge, topic knowledge, audience awareness, discourse organization knowledge, and familiarity with writing competence scales. Affective strategies cover regulation of writing anxiety and enhancement of writing self-efficacy. Communicative strategies involve brainstorming to generate ideas and peer interaction for exchanging feedback and corrections.

The primary assessors in this phase are students and writing teachers. Students conduct self-assessment to strengthen awareness of writing strategies, while teachers analyze the collected survey information to design more targeted instructional goals and plans, thereby consciously fostering students' strategic awareness throughout the teaching process.

##### B. During the Semester

During the semester, technological support is provided by the Chinese Chaoxing Course Platform, Automated Writing Evaluation (AWE) systems, screen recording software and keystroke logging tools, which offer interactive learning platforms and record daily learning behavior data. EFL teaching platforms can record daily learning behaviors, allowing evaluation of classroom performance, including activities such as brainstorming, quick-response exercises, timed in-class practice, and quizzes. Using platform functionalities, teacher assessment and peer assessment can be conducted in real time, with results immediately presented and shared with the whole class. The primary assessors are the students themselves, their peers, and the teacher. The purpose of this assessment is to enhance students' autonomy

and interactivity in writing learning, stimulate critical thinking, invigorate classroom dynamics, and improve overall instructional effectiveness.

For the assessment of EFL writing process, screen recording software and keystroke logging tools are used to capture students' real time writing process and strategies use. Combined with students' reflective logs or verbalized thinking, these tools allow the capture of learners' attention allocation and psychological states during timed writing tasks, and enable detailed case analyses to explore the dynamic characteristics of cognitive activities in writing.

The focus of writing process assessment is primarily on students' planning, drafting, and revision strategies during timed writing tasks. Emphasis on timed writing strategies is justified as follows: the predominant form of writing assessment in China is closed-book, timed examinations, in which students must write independently within a limited timeframe without external resources. In this context, strategies for attention allocation, planning, drafting, and revision have a substantial impact on writing outcomes.

For the assessment of EFL writing outcome, Automated Writing Evaluation (AWE) systems, the L2 Syntactic Complexity Analyzer (L2SCA), and the Lexical Complexity Analyzer (LCA) (Lu, 2016) are used. Leveraging the corpus-based technology of AWE, multiple indicators can be analyzed, including revision process data, types of textual errors, and syntactic and lexical complexity, providing both micro- and macro-level insights into the characteristics and developmental trends of students' writing output. AWE also offers an interactive writing platform that aggregates and analyzes typical errors and provides intelligent revision suggestions.

Within these platforms, the primary assessors are students themselves, their peers, and the teacher. To maximize the complementary strengths of each assessor, the following evaluation procedure is implemented: teachers and students collaboratively study the evaluation criteria; students conduct self-assessment and machine assessment, focusing on common lexical and grammatical errors, followed by revision; peer assessment addresses more challenging lexical and grammatical issues, as well as selected content and structural aspects, followed by another round of revision; and finally, teacher assessment focuses on remaining difficult lexical and grammatical issues, evaluates the relevance and adequacy of content, and ensures logical and cohesive structure, culminating in the submission of the final draft.

Teachers then use L2SCA and AWE to conduct a comprehensive analysis of textual features, including error types and trends, lexical richness, and syntactic complexity (Lu, 2016), which informs the adjustment of instructional priorities and difficulties. The system records detailed data for each writing task, including annotations and evaluation levels from students, peers, and teachers, thereby forming a writing portfolio. These portfolios serve as an important reference for understanding the development of students' writing competence and for conducting comprehensive assessments of their writing abilities.

### *C. End of the Semester*

At the end of the semester, a multifaceted Rasch measurement model (Linacre, 2013) is applied to conduct a fine-grained analysis of teacher assessment, self-assessment, peer assessment, and machine assessment in EFL writing domain. The analysis examines aspects such as rating severity, internal consistency, usage of scoring criteria, discriminative power of the criteria, and multifaceted interaction effects. This approach evaluates the reliability and validity of different assessors and provides quantitative evidence for optimizing a multi-dimensional assessment system, as well as further supporting the effective synergy between human assessment and machine assessment.

The multifaceted Rasch model allows measurement of different facets—such as learners' ability, task difficulty, rater severity, and scoring criterion difficulty—on a common logit scale, and calculates the measurement error for each value. The logit scale is an interval-level scale, enabling direct comparison across facets and individuals within each facet. This approach effectively overcomes limitations of classical test theory in examining validity, reliability, difficulty, discrimination, and feedback effects, offering a robust method for evaluating and refining a comprehensive EFL writing assessment system.

## V. CONCLUSION

The accompaniment-oriented human-machine collaborative assessment model demonstrates significant practical value. First, this model enables more comprehensive, precise, and timely collection and analysis of EFL writing learning data, and through dynamic feedback effectively regulates learning behaviors, thereby truly achieving assessment for learning and assessment for teaching, and promoting the integrated enhancement of learning, teaching, and assessment. Second, the model helps to strengthen students' awareness of writing strategies, encouraging them to reflect on and optimize their learning approaches during EFL writing, which in turn enhances their autonomous learning ability. Finally, the model provides important insights for improving teachers' assessment literacy, supporting instructors in conducting scientifically grounded and effective writing assessment based on multidimensional data, and fostering the professionalization and refinement of evaluation practices.

This model also possesses notable academic significance. First, it integrates the EFL writing learning process, writing process, and writing product into a unified assessment framework, expanding the research perspective on EFL writing evaluation and offering a more systematic and dynamic analytical approach. Second, the model deeply explores the teacher-self-peer-machine assessment collaborative model, grounding it in principles of educational and language measurement, communicative competence theory, and second language acquisition mechanisms. This not only enriches

the theoretical foundation of EFL writing assessment but also provides robust support for future research on multidimensional and comprehensive writing.

Future research is recommended to further investigate the learning-promoting effects of this comprehensive assessment model, including changes in students' EFL writing learning motivation, EFL writing self-efficacy, and EFL writing learning engagement, as well as their acceptance of the model. The representative cases from both higher- and lower-level groups in EFL writing performance can be examined to identify the differences in the use of EFL writing learning strategies and writing strategies. Such research will help reveal the impact of this assessment approach on EFL learners' attitudes and behaviors.

To conclude, the effectiveness of assessment for learning depends on the consistency among assessment content, assessment methods, assessment criteria, and educational objectives. This model fully integrates existing research on process-oriented and product-oriented assessment in EFL writing, while further clarifying the respective roles of teacher assessment, self-assessment, peer assessment, and machine assessment. In doing so, it establishes a comprehensive and systematic evaluation framework for EFL writing, which holds significant potential for enhancing learners' overall writing competence.

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