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ARTICLE

DIGITAL LITERACY IN THE AGE OF ARTIFICIAL INTELLIGENCE: EXPLORING STUDENT ENGAGEMENT WITH AUTOMATED WRITING EVALUATION (AWE) FEEDBACK[1]

LETRAMENTO DIGITAL NA ERA DA INTELIGÊNCIA ARTIFICIAL: EXPLORANDO O ENVOLVIMENTO DOS ESTUDANTES COM O FEEDBACK DA AVALIAÇÃO AUTOMATIZADA DE ESCRITA

ALFABETIZACIÓN DIGITAL EN LA ERA DE LA INTELIGENCIA ARTIFICIAL: EXPLORANDO LA PARTICIPACIÓN ESTUDIANTIL CON LA RETROALIMENTACIÓN DE LA EVALUACIÓN AUTOMATIZADA DE ESCRITURA

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ABSTRACT:
While artificial intelligence (AI) has permeated language education, it is crucial to understand that learners are at the center of education and instructional scaffolding needs to be provided for them to improve their engagement with digital technologies. Situated in the context of second language (L2) writing, the article first reviews two key terms - digital literacy and student engagement, and then focuses on a recent study that integrated digital literacy and student engagement in L2 writing research and proposed an integrated model by synthesizing multiple components of digital literacy and tripartite dimensions of student engagement. It is suggested that digital literacy, characterized by an awareness of the affordances and constraints of digital technologies, an ability to evaluate digital information, and a willingness to use digital technologies for peer collaboration, is key to effective student engagement in language learning in the age of AI.
Keywords: digital literacy, student engagement, automated feedback, L2 writing, artificial intelligence
RESUMO:
Embora a inteligência artificial (IA) tenha permeado a educação linguística, é crucial entender que os aprendizes estão no centro da educação e que é necessário fornecer um suporte instrucional para melhorar seu engajamento com as tecnologias digitais. Situado no contexto da escrita em segunda língua (L2), o artigo inicialmente revisa dois termos-chave – letramento digital e engajamento estudantil – e, em seguida, foca em um estudo recente que integrou letramento digital e engajamento estudantil na pesquisa sobre escrita em L2, propondo um modelo integrado ao sintetizar múltiplos componentes do letramento digital e dimensões

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tripartidas do engajamento estudantil. Sugere-se que o letramento digital, caracterizado por uma consciência das potencialidades e limitações das tecnologias digitais, uma capacidade de avaliar informações digitais e uma disposição para usar tecnologias digitais para colaboração entre pares, é fundamental para um engajamento estudantil eficaz na aprendizagem de línguas na era da IA.
Palavras-chave: letramento digital, engajamento estudantil, feedback automatizado, escrita em L2, inteligência artificial
RESUMEN:
Aunque la inteligencia artificial (IA) ha permeado la educación lingüística, es crucial entender que los estudiantes están en el centro de la educación y que se necesita proporcionar un apoyo instruccional para mejorar su compromiso con las tecnologías digitales. Situado en el contexto de la escritura en una segunda lengua (L2), el artículo primero revisa dos términos clave – alfabetización digital y compromiso estudiantil – y luego se enfoca en un estudio reciente que integró alfabetización digital y compromiso estudiantil en la investigación sobre escritura en L2, proponiendo un modelo integrado al sintetizar múltiples componentes de la alfabetización digital y dimensiones tripartitas del compromiso estudiantil. Se sugiere que la alfabetización digital, caracterizada por una conciencia de las posibilidades y limitaciones de las tecnologías digitales, una capacidad para evaluar información digital y una disposición para utilizar tecnologías digitales para la colaboración entre pares, es clave para un compromiso estudiantil efectivo en el aprendizaje de idiomas en la era de la IA.
Palabras clave: alfabetización digital, compromiso estudiantil, retroalimentación automatizada, escritura en L2, inteligencia artificial

Introduction

The emergence of artificial intelligence (AI) and its application to education have transformed language teaching and learning dramatically. Now more than ever do we have access to a multitude of digital technologies at hand to go about language learning. The field of second language (L2) writing is particularly influenced by the emerging technologies as L2 writers often turn to automated writing evaluation (AWE) programs to seek timely feedback to improve their writing. Recent AWE programs are powered by generative AI that responds to writers' prompts to generate new and original content.

However, it is important to keep in mind that it is the users' effective engagement with the feedback provided by generative AI that leads to writing improvement. L2 student engagement, therefore, is a key element in the uptake of AWE feedback and their writing development. To reap the benefits of digital technologies in L2 writing, L2 students also need to equip themselves with digital literacy to evaluate AWE feedback, utilize technologies, and engage in social interaction to improve their writing. This article will first introduce two key concepts - digital literacy and student engagement, and then review extant research on student engagement with AWE feedback in L2 writing with special attention on a recent study on

student digital literacy in L2 writing, and finally discuss the implications of generative AI in language education as well as future research directions in L2 writing.

Digital literacy

The term “digital literacy” was introduced by Gilster (1997), a historian and educator, who identified the importance of critical thinking skills and core competencies in the age of Internet and defined the term as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 1). The concept of digital literacy caught on fast and began to attract growing scholarly attention. Early research on digital literacy focused on individuals’ abilities to read and understand information in different digital formats, such as hypertext and in different multimedia systems (Bawden, 2001, 2008) and online networks (Hargittai, 2005) by using digital and information technologies. Later, digital literacy was seen as a social practice that goes beyond the abilities to read and write in digital platforms. It is concerned with how individuals use digital technologies to construct meaning according to their needs in different social contexts (Lankshear and Knobel, 2008). Focusing on the pragmatic aspects of communication in digital literacy, Burniske (2007) argued that it is significant to consider ethical conduct and critical evaluation of content. Likewise, Lankshear and Knobel (2008), and Meyers, Erickson and Small (2013) also emphasized the social and communicative practices in understanding digital literacy as individuals constantly engage in digitally codified meaning making activities. Research on digital literacy built on new social practices such as social media to expand the definition of digital literacy to a multimodal outlook in an increasingly new textual landscape (Tan, 2013). The definition of digital literacy was further extended with the addition of a critical approach - critical digital literacy as “those skills and practices that lead to the creation of digital texts that interrogate the world; they also allow and foster the interrogation of digital, multimedia texts” (Ávila and Pandya, 2012, p. 3).

Multiple definitions of digital literacy have been proposed by different researchers to understand this concept in broad educational contexts. To understand digital literacy and its relevance to linguistics and communication practices, Jones and Hafner (2012) proposed a five-dimension model to explore the linguistic and social impact of a host of new digital literacy practices, which encourages language learners to reflect on and critically evaluate their own language and communication practices as follows:

- *Doing* refers to the actions in the physical world including sharing texts, images, or videos as well as using search engines to find information.
- *Meaning* is concerned with forms of representation, such as reading multimodal web pages and hypertext.
- *Relating* involves patterns of interaction that include managing online relationships, interaction between writers and readers, and collaboration among peers.
- *Thinking* is about experiencing and thinking about reality mediated through digital tools.
- *Being* is understood as a social identity that people present and assume in a digital world.

Specifically, these researchers highlighted two areas relevant to language learning based on their five-dimension model of digital literacy (Hafner, Chik and Jones, 2015): (1) the needs of learners created by new modes of reading, writing, and communication in language education, and (2) new contexts of language learning created as a result of the multilingual environments of global online contexts.

Student engagement

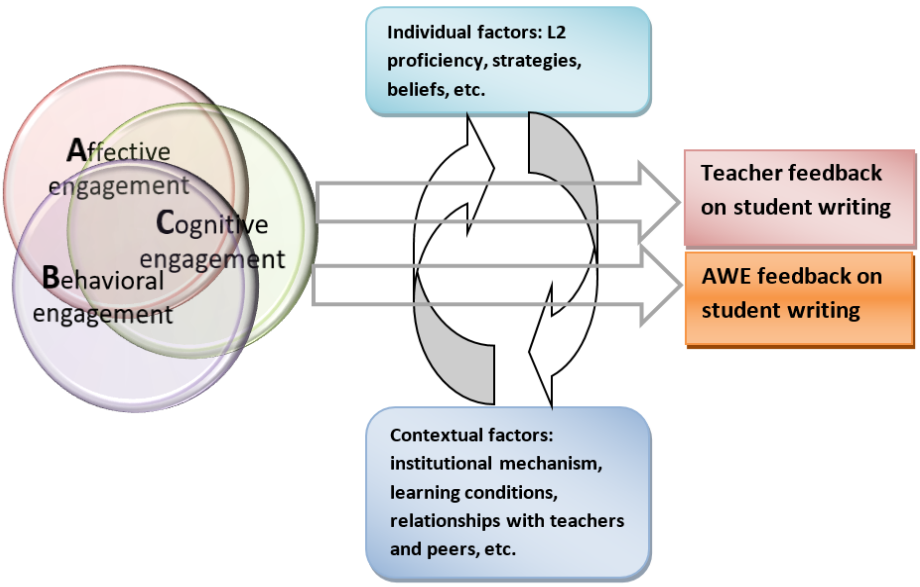
Research on the concept of student engagement traces back to the work of educational psychologists (*e.g.*, Pace, 1984; Tyler, 1969) where attention was given to student engagement with teachers, peers, classrooms and schools. Most early studies on student engagement were prompted by a lack of student involvement in academic activities as withdrawal, alienation, and drop-out problems were often reported by researchers (*e.g.*, Case, 2007; Finn, 1989; Mann, 2001). Student engagement has been conceptualized as a complex meta-construct that encompasses different components. For instance, Anderson *et al*. (2004) examined student engagement in schools in the US and identified four types of engagement: (1) behavioral (*e.g.*, attendance, participation in classroom and extracurricular activities), (2) academic (*e.g.*, time-on-task; learning time), (3) cognitive (*e.g.*, use of learning strategies in academic activities, self-regulated learning), and (4) psychological (*e.g.*, sense of belonging at school; relationships with teachers and peers). They believe that the taxonomy of student engagement has heuristic value for a better understanding of student participation, experiences, and performance at school. Dunleavy (2008) investigated learner engagement at Canadian secondary schools and classified learner engagement into three dimensions: (1) behavioral (*e.g.*, attendance, participation in academic and non-academic school activities), (2) academic-cognitive (*e.g.*, homework completion, time-on-task, response to challenges in learning, effort in learning), (3) social-

psychological (*e.g.*, interest, motivation, need for autonomy, sense of belonging). One of the most widely cited categorizations of student engagement was proposed by Fredricks, Blumenfeld and Paris (2004). In their review of some 40 studies on student engagement, they synthesized various definitions and classifications of engagement and proposed three major dimensions of engagement: behavioral, emotional, and cognitive. Behavioral engagement refers to students' positive behaviors and involvement in academic tasks, and participation in academic and extracurricular activities. Emotional engagement is concerned with students' emotions, attitudes towards teachers, peers, and school, as well as a sense of belonging at school. Cognitive engagement involves students' personal investment in their learning, the use of learning strategies, and self-regulation.

Among the multiple classifications of student engagement, the three-dimension engagement proposed by Fredricks, Blumenfeld and Paris (2004) seems to be more applicable to language learning as the identification of behavioral, emotional and cognitive dimensions finds its relevance to language learning research, such as motivation, affective orientations, cognitive traits, and learning strategies (*e.g.*, Dörnyei, 2005; Garrett and Young, 2009; Griffiths, 2015; Oxford, 2003). This tripartite conceptualization of student engagement has been already adopted in a number of studies on second language acquisition (Ellis, 2010) and L2 writing (Han and Hyland, 2015; Zhang, 2017; Zhang and Hyland, 2018) where engagement is found to be a key component in student uptake of feedback and writing improvement. In these studies, behavioral engagement concerns time on task, and emotional engagement is examined through affective responses, attitudinal reactions, and motivational changes, while cognitive engagement refers to the use of cognitive and metacognitive strategies to respond to feedback.

The engagement model of Zhang and Hyland (2018) offers a good starting point to examine student engagement with specific activities in language learning. Informed by the tripartite conceptualization of engagement proposed by Fredricks, Blumenfeld and Paris (2004), Zhang and Hyland (2018) proposed an engagement model to analyze how students behaviorally, emotionally, and cognitively engage with teacher and automated writing evaluation (AWE) feedback on academic writing (Figure 1).

Figure 1. A model of student engagement with teacher and AWE feedback



Source: (Zhang and Hyland, 2018)

In this model, student engagement is influenced by a number of individual and contextual factors. Behavioral engagement is concerned with students' revision actions and time spent on revision; affective engagement is examined via students' emotional responses and attitudinal reactions; and cognitive engagement is measured by how students use revision operations and cognitive and metacognitive strategies in their revision.

Student engagement with automated writing evaluation (AWE) feedback

AWE systems have been receiving growing scholarly attention since their emergence in the 1960s. Recent developments have enabled AWE systems (*e.g.*, Criterion® and MY Access!®, *Pigai*, Grammarly) to assess student writing by offering immediate feedback on grammar and mechanics (Attali, 2004), identify content and organization problems (Weigle, 2013), and alert students to genre conventions and rhetorical moves (Cotos, Huffman and Link, 2020). AWE systems draw on rapid developments in latent semantic analysis, natural language processing, and AI whereby improved statistical methods are being developed to constantly improve their performance (Stevenson and Phakiti, 2014). Program developers, classroom teachers and education researchers have commended AWE systems for the immediacy of their diagnostic feedback, the opportunities they offer for multiple drafting, and their role in formative writing assessment (Cotos, 2018; Dikli, 2006; Warschauer and Ware, 2006; Zhang and Hyland, 2022). Despite their advantages, AWE programs have evoked criticism for their

low accuracy rates in identifying errors of grammar, mechanics, and collocation (Bai and Hu, 2017; Dikli and Bleyle, 2014), overemphasis on the use of transition words in student writing, and their preference for length over brevity (Chen and Cheng, 2008). It is worth noting that AWE feedback is not a panacea for student writing problems because its efficacy is largely contingent on how students engage with it effectively to make revisions.

Research on student use of AWE feedback produced mixed results. Researchers reported a reduction in errors in student writing and an improvement of holistic scores after interacting with AWE feedback generated by Criterion® (El Ebyary and Windeatt, 2010; Li, Link and Hegelheimer, 2015), suggesting a positive impact of AWE feedback on student learning. Students who used the same AWE system Criterion® in other studies, however, were found to have low submission and resubmission rates, which is an indication of a lack of student involvement with AWE feedback (Attali, 2004; Warschauer and Grimes, 2008). Studies have also explored students' perceptions of and attitudes toward AWE systems and AWE feedback with both positive and negative responses in different research contexts (Chen and Cheng, 2008; Grimes and Warschauer, 2010; Dikli and Bleyle, 2014; Wang, Shang and Briody, 2013; Zhang, 2017, 2020; Zhang and Hyland, 2018, 2023; Zhang and Xu, 2022).

While there is no consensus over the effectiveness of AWE systems in student writing, a growing number of recent studies have pointed out the importance of student engagement in their use of AWE systems. For instance, Zhang (2017, 2020), investigated how L2 learners responded to AWE feedback provided by *Pigai* on their writing behaviorally, emotionally, and cognitively, and found that student engagement with AWE feedback is a complex process whereby students not only need to regulate their emotions but also use cognitive strategies to interact with AWE feedback. Bai and Hu (2017) examined a group of L2 students' responses to AWE feedback generated by the same program *Pigai* on grammar, mechanics, collocations, and synonyms, and their uptake of AWE feedback. The students were found to use AWE feedback selectively and adjusted their uptake based on their judgements about the accuracy and explicitness of AWE feedback. In his study of 82 L2 students using AWE feedback offered by Criterion®, Ranalli (2018) found that the explicitness of AWE feedback and the L2 proficiency levels of the students affected their engagement with AWE feedback. Ranalli (2021) continued this line of research and found that students' trust in another AWE system Grammarly had an influence on their uptake of AWE feedback and their revisions. A recent study explored the possibility of using a generative AI chatbot ChatGPT as an AWE system to aid student revision (Koltovskaia, Rahmati and Saeli, 2024). It is found that the students behaviorally engaged with ChatGPT for low-order concerns, and showed both doubts and

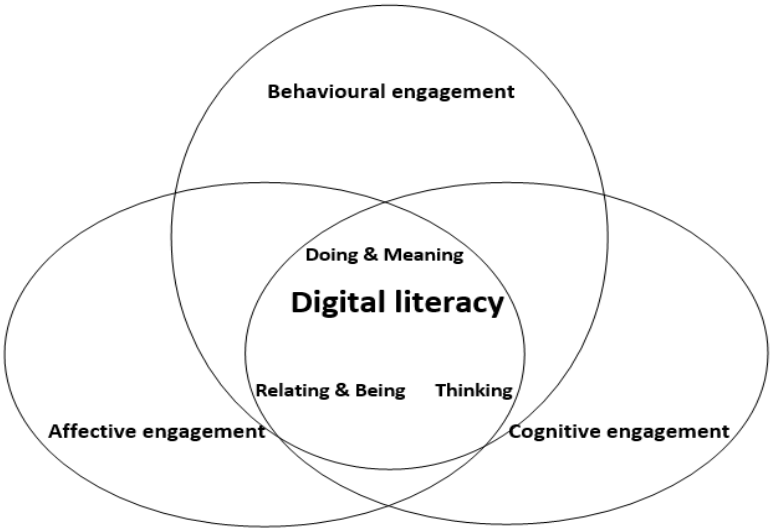
satisfactions in their cognitive and affective engagement with the AI chatbot. Overall, extant studies suggest that student engagement is key to unlocking the learning potential of AWE feedback (Zhang and Hyland, 2018), but few have examined the significance of student digital literacy and its role in effective student engagement. The next section will present a recent study on how digital literacy influenced student engagement with AWE feedback on L2 writing.

A case study of digital literacy in AWE feedback research

Zhang and Hyland (2023) explored the construct of digital literacy and its application to L2 writing feedback research. They drew on the previous research on digital literacy, particularly the model of digital literacy proposed by Jones and Hafner (2012) to conceptualize digital literacy. In their study of a group of L2 students, they found that the students' digital literacy had a great impact on their effective and successful engagement with AWE feedback in their writing and revision. One of the focal participants, Jing, demonstrated a high level of digital literacy through her understanding the affordances and constraints of digital tools. In her interaction with the AWE system Pigai, Jing capitalized on its strengths over teacher feedback to improve her writing without letting its weaknesses derail her writing development. The other participant, Liang, displayed an ability to critically evaluate digital information generated by the AWE system by cross-checking multiple sources of information before making decisions in his revision, which is also a component of digital literacy. Shu, the third participant, showed an awareness of peer collaboration in her revision as she made good use of digital technologies for peer interaction and benefited from peer learning in a digital environment. This awareness is also a hallmark of digital literacy in this study. In their conceptualization of digital literacy, Zhang and Hyland (2023) suggest that digital literacy encompasses "an awareness of the affordances and constraints of digital technologies, an ability to evaluate digital information, and a willingness to use digital technologies for peer collaboration" (p. 22). Their study calls for more scholarly attention to the role of digital literacy in student engagement with digital technologies powered by AI.

Apart from the conceptualization of digital literacy, Zhang and Hyland (2023) integrated their own engagement model with feedback and the five-dimension model of digital literacy of Jones and Hafner (2012) by showing how the two models interact and map onto each other.

Figure 2. An integrated model of digital literacy and student engagement



Source: (Zhang and Hyland, 2023)

In this integrated model, Zhang and Hyland (2023) grouped *doing* and *meaning* together as they believe that both involve reading, writing, interpreting, and communicating. They suggested that *relating* and *being* coalesce in a way that language learners construct their identities (being) through relating to others and the world (Norton and Toohey, 2011). They further explained that the construct of digital literacy interacts with student behavioral, affective, and cognitive engagement in the following ways (Zhang and Hyland, 2023, p. 6):

- *Thinking* by developing an awareness of the affordances and constraints of AWE technology to their writing development
- *Doing and meaning* by using AWE feedback to conduct revision operations
- *Relating and being* by interacting with peers in online communities and constructing an identity as a learner and writer in peer groups

By synthesizing two constructs – student engagement and digital literacy – this integrated model has the potential to inform future studies on how students respond to different types of feedback on writing and interact with digital technologies.

Conclusion

In the era of AI, being literate goes beyond the ability to read and write in the traditional way as all types of communication are increasingly mediated by digital technologies. Therefore, digital literacy, characterized by an awareness of digital affordances and constraints, an ability to evaluate information, and a willingness for social interaction, is a much-needed competence for all language learners. In order for learners to engage with digital technologies more effectively, it is of great significance to understand how different dimensions of engagement – behavior, affective, and cognitive interact with each other in the learning process and how to facilitate optimal student engagement with digital technologies in their learning. Teachers are expected to provide scaffolding to assist students in acquiring digital literacy and facilitating effective student engagement.

More research on student engagement and digital literacy is needed in the field of L2 writing as AI has been evolving at an unprecedented rate and exerted a profound impact on L2 writing. Future studies can expand the tripartite dimension of student engagement to examine how to further enhance student engagement with digital technologies in their learning. With the advent of generative AI, it is also worth considering how to cultivate students' evaluative skills to provide valid and effective prompts for chatbots such as ChatGPT to generate high-quality content. This merits further research on the construct of digital literacy and its role in student engagement with fast-developing digital technologies.

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