Research Paper

Language Teachers' Assessment Literacy in AI-aided Adaptive Learning Environments

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Abstract

AI-aided Language Assessment Literacy (LAL), is a pivotal aspect of modern teaching, posing both an indispensable asset and a formidable challenge. Despite its paramount importance, research on teachers' LAL, especially in the context of AI-aided tools, has been notably scarce. This paper addresses the research gap by conducting a practical investigation, emphasizing the application of LAL concepts with a special focus on integrating Artificial Intelligence in language assessment. For this purpose, 261 EFL teachers of three groups (i.e., novice teachers with one to three years of experience, senior teachers with three to five years of experience, and experienced teachers with more than five years of experience) participated in the research. Then the process of pre-test, 50-hour teacher training course, 16-session teaching in *Magic School* or *Edapp* environment, post-test, and interview were conducted. The reasons for choosing these platforms were that they offer Adaptive Learning Environments (ALE), are integrated with AI and accessible, and have a simple user interface. The mixed methods analyses of the experiment data showed that: AI-aided ALE training has led to the development of teachers' LAL; regarding teaching quality, the teachers' performance decreased from *G3* to *G2* and finally *G1* respectively; while in the case of the LAL variable, *G2* outperformed the others.

Keywords: Language Assessment Literacy; Adaptive Learning Environment; AI-aided Teaching-Learning; AI-aided Adaptive Learning Environment; Language Teaching; Teaching Quality.

1. Introduction

In recent decades, with the advancement of technology and changes in educational approaches, the use of student-centered methods instead of teacher-centered ones in the field of education has been proposed as one of the important aspects of educational reforms (Almari et al., 2021; Christodoulou & Angeli, 2022; Walkington & Bernacki, 2020). This transition to a constructivist perspective in education places more emphasis on a student-centered approach in which the focus is on the needs and characteristics of each student. Such evolution has changed the roles of teachers and students and transformed teachers from controllers of the learning process to designers of learning (Christodoulou & Angeli, 2022).

In this context, it is vital to understand the relationship between the four basic aspects of teacher training, teachers' assessment literacy, modern facilities and tools, and the teaching quality (TQ). Therefore, understanding the importance of assessment in education is of particular importance. Assessment is an integral part of the educational process since effective and efficient education will not be possible without correct assessment of students (Delgado & Rodriguez, 2022; Khodashenas et al., 2022; Marandi, Janatifar, & Nafisi, 2021). So far, studies on teachers' LAL also showed that one of the essential aspects of the success of the learning process is teachers' literacy in language assessment (Razavipour, 2014; Weng and Shen, 2022). Assessment of student performance provides an opportunity for teachers to receive feedback on the efficiency and effectiveness of teaching methods used in the classroom and to improve their methods. Teachers' assessment literacy, especially in the field of language education, plays a key role in improving the quality of teaching, and teachers must be able to use appropriate methods and tools for proper and targeted assessment of students (Weng & Shen, 2022). For this reason, the quality of education is largely influenced by the teachers' LAL at a

proper level. In other words, LAL indicates teachers' ability to elucidate and use findings to optimize the learning process (Larenas & Brunfaut, 2023; Christodoulou & Angeli, 2022). Also, the assessment provides essential data for informed decision-making to educational managers and generally improves the quality of the educational system.

With the integration of Artificial Intelligence (AI) and Adaptive Learning Environments (ALEs), teaching has become a more than traditional experience, and thus the process of improving students' language learning has also been affected (Xie et al., 2019). Despite today's advancements, the main model of language teaching-learning in adults is still known as a central model where the teacher stands in front of the students and presents the content. This model ignores some of the most important aspects affecting education, such as learners' portfolios, differences in their abilities and preferences, teacher's freedom of action, the validity of assessments, and the quality of teaching. In ALEs integrated with AI, personalization and continuous-dynamic assessment are possible and help to optimize the learning process and address the learning needs of students individually and specifically (Jin & Fan, 2023; Voss et al., 2023; Xi, 2023). Therefore, the development of teachers' LAL plays a decisive role in such an environment. With these advancements, assessment has also taken on new and more complex roles. In such environments, AI can facilitate analyzing the data from the assessments and help teachers set specific educational objectives for each student (Salas-Pilco, Xiao & Hu, 2022). This connection between LAL and digital technology leads to the optimization of the learning process and an increase in the quality of education and enables teachers to respond more effectively and accurately to the learning needs of their students (Khodashenas et al., 2022; Marandi, Janatifar, & Nafisi, 2021; Delgado & Rodriguez, 2022).

The manipulation of AI and technology in assessment can further help teachers to better comprehend the needs and problems of students and provide more flexible solutions (Bannister, 2024; Zhong et al., 2019). In this scenario, the concept of LAL is more important than ever, according to the different experiences of teachers, including *Novice* teachers, *Senior* teachers, and *Experienced* teachers. *Novice* teachers need a learning and adaptation process to become familiar with new educational environments and technology tools. *Senior* teachers need to master the relationship between traditional tools and technology. Also, *Experienced* teachers may face unique challenges and opportunities in using technology in the learning process (Hwang et al., 2020). Besides, this ability in AI-aided Learning Environments can be an effective tool to improve both learning and teaching processes (Zhong et al., 2019).

AI systems offer the possibility to provide more effective support for optimal digital learning-teaching, including customized learning, adaptive learning, self-regulation, automating regular tasks of instructors, enhancing and facilitating adaptive assessments, designing and delivering meaningful activities, strengthening motivation, and providing quick and comprehensive support (Seo, Tang, Roll, Fels & Yoon, 2021; Wei, 2023). The adaptive approach enables personalized learning by adapting instruction to self-directed learning paths and enhances learner motivation, satisfaction, engagement, and efficiency (Gomez et al., 2014; Walkington, & Bernacki, 2020, Peng & Spector, 2019; Xie et al., 2019). Also, by utilizing AI in Adaptive Learning Environments (ALEs), the possibility of personalizing the learning process increases (Walkington, & Bernacki, 2020, Xie et al., 2019). In this context, the notion of adaptive learning deals with reconciling learning to the needs and preferences of each student (Gomez et al., 2014). Such developments have led to the expansion and acceptance of AI-based education platforms and the strengthening of personal adaptive learning experience as an important learning possibility (Walkington & Bernacki, 2020). In this regard, the results of previous studies showed that increasing the level of LAL and using it as a teaching tool also improves the quality of teaching (Xu & Brown, 2016). Therefore, trying to investigate this concept, understanding its various dimensions, and knowing its practical function, play important roles in the development and improvement of educational methods in modern learning environments.

Following the theoretical framework of Wei (2023) and Weng and Shen (2022), this study contemplates LAL in the presence of the complexities of AI to investigate the connection between AI-assisted tools and the multifaceted dimensions of LAL among language teachers in ALEs. By providing a comprehensive exploration of LAL and addressing a thematic focus on the integration of digital technologies in language teaching, this paper contributes insight into the impact and opportunities of AI-assisted language teaching.

2. Literature Review

In recent years, researchers have increasingly shown interest in assessment literacy (AL) and LAL. Fulcher (2012) defined LAL as the set of skills and knowledge needed to design, develop, and assess tests, both standardized and classroom-based. This collection requires an understanding of test processes, ethical considerations, and contextual

frameworks, how to implement them, and how to analyze data. This comprehensive definition also highlights the significance of comprehending the historical, social, political, and philosophical aspects of such a concept to evaluate its effects on societies, institutions, and individuals in education (Larnas & Brunfoot, 2023). Based on this, different levels of assessment literacy (AL) are defined according to the needs of the stakeholders. For example, Pill and Harding (2013) have addressed the needs of test takers and policymakers and proposed a five-level chain of LAL that extends from illiteracy and over-nominal to functional, procedural-conceptual, and multi-dimensional. Likewise, Taylor (2013) introduced eight LAL components including knowledge of theory, technical competencies, principles and concepts, language pedagogy, sociocultural ethics and morals, local customs, personal beliefs/attitudes, scores, and decision-making, suggesting diverse needs among stakeholders.

Although, empirical studies by Baker and Riches (2018) and Kremmel and Harding (2020) confirmed and expanded these components, the relationships among LAL components remain unclear. Kremmel and Harding's (2020) survey identified nine teachers' LAL components, validating some of Taylor's hypotheses while indicating the need for differentiation in others. For instance, they merged Taylor's "sociocultural values" and "local practices" into a single component labeled "assessment policy and local practices." Additionally, they separated Taylor's "language pedagogy" into two components: "assessment in language pedagogy" and "washback and preparation" (Larenas & Brunfaut, 2023).

Similarly, language and the importance of its assessment literacy form an essential part of the professional competence of language teachers (Weng & Shen, 2022). Indeed, teachers' inadequate LAL may lead to unstable language test design, misinterpretation of test results, and improper instructional decisions which may have negative effects on students. Nevertheless, despite the vital role of LAL in teaching and assessment, teachers' LAL capabilities are unfortunately still insufficient (Berry et al., 2017; Weng & Shen, 2022; Xu & Brown, 2016). Even TESOL courses for pre-service and in-service teachers do not provide enough content to develop language assessment, and this issue highlights the necessity of rooting the problem and trying to solve it (Jeong, 2013; Weng & Shen, 2022). Perhaps the reasons related to this weakness can be found in two main groups of factors affecting LAL in teachers, namely individual factors and background factors (Xu & Brown, 2016; Weng & Shen, 2022). In the first group, factors such as teachers' language backgrounds, years of teaching, educational qualifications, personal experiences, and fields of study had a significant effect on their LAL (Xu & Brown, 2016); While in the second group, factors such as different assessment cultures, educational policies and debates at the national and local policies, educational objectives, and institutional guidelines and infrastructure affect teachers' LAL (Gu, 2014; Yan et al., 2018; Mansouri et al., 2021; Firoozi et al., 2019).

On the other hand, the study of the intersection of LAL and AI in language teaching is an emerging aspect that offers an undeniably transformative perspective. In their studies, Tsai, Tsai, and Lin (2015) and Schmidt and Strasser (2022) believed that the integration of AI tools in language education leads to the formation of potential competencies in advanced assessments, providing personal feedback and adaptive learning. They believed that the competencies of AI facilitate accurate language assessment in aspects such as providing comparative assessment and creating a balance between evaluations and learners' needs, as well as their learning styles. Romero and Ventura (2020) reviewed educational algorithms and data mining through AI and found that AI tools in assessment also help facilitate efficient grading processes to identify areas in need of targeted support in learners, recognize language development patterns of each individual, and experience personal learning. The utilization of AI in AL systems leads to the development of customized educational interventions, personalization, responsibility for learning progress, individualized training and adaptive learning, and the reduction of learning conflicts (Perrotta & Selwyn, 2020; Seo, Tang, Roll, Fels & Yoon, 2021; Schmid & Petko, 2019; Wei, 2023; Zhong et al., 2019), along with teachers' personal and professional learning (Tammets & Ley, 2023). In addition, results showed that a thorough understanding of LAL as a set of abilities and knowledge in using assessment methods and applying the right tools at the right time will improve teachers' skills in designing tests, analyzing data, and subsequently improving learning (Pill & Harding, 2013; Weng & Shen, 2022).

2.1 LAL in Adaptive Learning Environment

As assessment plays a vital role as one of the determining factors of the teaching process, strengthening the LAL of language teachers in ALEs has taken a new form as a method to reflect on teaching to achieve educational objectives. As Marandi, Janatifar, and Nafisi (2021) and Weng and Shen (2022) discussed, the two factors of assessment and education are complementary to each other since assessment as a continuous process, whether consciously or unconsciously, causes a review of the set of teaching methods and tools. Harding and Kremmel (2016) stated that language

teachers, as the main users of language assessment, should have the necessary knowledge, skills, and abilities regarding the principles and methods of assessment. They emphasized that this set of capabilities leads to developing the ability and knowledge necessary to design and develop measurement tasks, perform measurements, and analyze collected data to evaluate performance and review methods and tools. According to them, LAL allows teachers to create more targeted assessment plans to benefit from its results in their educational decisions.

Therefore, it can be accepted that in an ALE, LAL is introduced as a key tool that language teachers benefit from to better organize the learning and teaching process. This capability in an ALE grants language teachers to use assessment data to adjust the teaching and learning process. Finally, by increasing their LAL in ALE, language teachers can experience impact and improve the quality of their teaching. These improvements are aimed at increasing students' learning activities, adapting to their needs and preferences, and creating an active and personalized learning process.

2.2 The Adaptive Artificial Intelligent Learning Environment and Quality of Teaching

Quality of teaching, historically, has been defined in diverse ways - from subject matter expertise and high grades to compliance and teaching enthusiasm. In current conversations about teacher preparation and professional development, definitions of teaching quality are often placed in the background and are not demarcated. In other words, teaching ability was previously considered an inexplicable characteristic; it means that teachers either have this ability or they don't, and it cannot be predicted or prepared for by training. While in new studies, it refers to the set of teacher's abilities and subject expertise that can be mediated or moderated (Lee, 2016).

High-performing education systems challenge the notion that teaching ability cannot be learned and emphasize a distinct body of knowledge and expertise that teachers may acquire and enhance over time, aligning with the belief that, just like all children can learn, all teachers can learn as well. Many educational systems worldwide, including the U.S., Australia, Canada, Singapore, Finland, and China, articulate the knowledge and competencies teachers must be equipped with through standards of practice. Inferred from research on effective teaching, such criteria guide teachers' preparation, practice, assessment, and professional growth, clarifying expectations for teachers and those who support them. Meanwhile, the theoretical model proposed by Manasia, Ianos, and Chicioreanu (2019) is inspired by the model of Wang, Lai, and Lo (2014). It encompasses four central dimensions of effective-quality teaching, three of which are derived from various professionalism frameworks, while the fourth one (i.e. self-management), is suggested by them as follows:

- Professional knowledge: As defined by Wang et al. (2014), refers to a set of knowledge required for educational tasks acquired through pre- and in-service training and active development of professional networks. Assunção Flores (2016) argued that teachers benefiting from training show high self-confidence and constructive relationships with students. Pedagogical and subject matter knowledge improve teachers' job performance.
- Teaching philosophy: A dimension of teaching readiness, aligns with Danielson's framework for teaching (Wang et al., 2014), encompassing instructional design, creating simulative learning environments, and the instructional mission of teachers. It represents the translation of professional knowledge into practice, including goal setting, designing instructional strategies, developing assessment tools, using feedback, and creating learning environments adapted to the individual needs of students.
- Professional engagement measures a teacher's investment in school-related activities. It includes planned practices, persistence, professional development aspirations, superintendence aspirations, and networking. This dimension extends beyond the classroom, focusing on reflection, service to school and society, personal development, and ethical conduct.
- Self-management: Originated in project management science, corresponds to the last dimensional of Danielson's framework (Wang et al., 2014). It involves teachers' proactivity in their careers, including creating opportunities, enhancing visibility, seeking advice, setting objectives for professional development, designing attainment strategies, managing time, and self-evaluation.

The concept of AI was first coined by John McCarthy in 1956, and today, with the development of intelligent machine technology and applications, it has brought about significant changes in education (Penn, 2020; Xie et al., 2022). AI tools have formed interactive platforms that focus on aspects such as attention, motivation, and individual differences in learners, and in addition to monitoring the level of individual learning progress, they provide solutions to face the challenges of interaction in the classroom (Khosravi et al., 2020). According to Akgun and Greenhow (2022), Borge

(2016), and Wei (2023), one of the most fundamental applications of AI is the assessment of learners, which not only allows accurate and timely measurement of learning levels and facilitates educational approaches, but also adapts to the needs, preferences and rate of progress of the student, and thus motivates promotes AI training systems, equipped with automated advisory programs, enhance self-learning skills, individual guidance (Wei, 2023), and foster practical training and language development (Barnes-Hawkins, 2016; Andujar & Spratt, 2023; Khosravi et al., 2022). In addition, Demartini et al. (2024), Xie et al. (2022), and Peng and Spector (2019) acknowledged that teachers who use ALEs with the help of AI, strengthen personal learning in the learner. Through AI-based adaptation, adaptive approaches allow teachers to gain real-time insights into each learner's progress, strengths, and areas of need for improvement, as well as instant feedback and creativity development (Jaeger, 2016). In this way, they can adjust their educational strategies more effectively or improve their professional skills and thus experience continuous professional development (Díez-Arcón & Martin-Monje, 2023).

In general, to date, the functions and potentials of AI in the quality of teaching, as well as other aspects of education, can be reviewed from three basic aspects of AI: AI applications, especially natural language processing (NLP), have important consequences in the quality of teaching. NLP is a combination of AI and linguistics that automates human language processing and thus analyzes. It produces written and spoken language, including Intelligent Language Learning Systems (ILTS) that support lexical, grammatical, and semantic aspects, providing appropriate language learning (Schmidt & Strasser, 2022). The second is machine learning (ML), which helps to enhance the quality of education by extracting insights from experience, for example, by solving problems such as speech recognition and speech robotics that affect the quality of education through the development of language-related programs (Schmidt & Strasser, 2022). Third, deep learning (DL), by using artificial neural networks similar to human brain networks and by focusing on vision-based categories such as image discrimination, enhances language processing capabilities and contributes to the quality of training (Schmidhaber, 2015; Schmidt & Strasser, 2022). Therefore, the integration of NLP, ML, and DL in educational technologies provides valuable tools to enhance the quality of teaching by facilitating syntax-to-semantic revision, providing personalized support and performance optimization, and developing individual learning that remains understudied.

This study was conducted to determine the effectiveness of LAL on the quality of teaching in an AI-aided ALE. Pursuing this goal not only fills the gaps in the shortage of practical studies of AI integration in language teaching but also leads to the expansion of existing knowledge in educational technology and helps language teachers and users develop a practical action plan for applying AI. This study seeks to address the following research inquiries:

1. To what extent do the instructional interventions contribute to the development of teachers' LAL?
2. Is there any statistically significant difference between the groups concerning their LAL and TQ?
3. What are the advantages and disadvantages of AI-aided ALE for teachers?

3. Methodology

3.1. Participants

This research involved 261 Iranian English as foreign language teachers from three experience levels (i.e. less than three years, three to six years, and more than six years) working with adult language learners. The participants were divided into three professional groups of Novice teachers, Senior teachers, and Experienced teachers. Furthermore, to gain comprehensive insights regarding the third research question, interviews were carried out with a subset of the participants, including 15 teachers from each group (a total of 45 interviewees). The selection of interviewees followed a careful purposive sampling approach, wherein educational management personnel in the language centers and instructors collaborated to identify learners exhibiting outstanding linguistic proficiency and diverse backgrounds. Additional details regarding the sample composition are available in Table 1.

Table 1. *Sample Description*

Group	Age	Number	Gender	Number
Novice Teachers (G1)	19-25	49	Female	25
			Male	24
	26≤	38	Female	18
			Male	20

Senior Teachers (G2)	19-25	27	Female	14
			Male	13
	26≤	56	Female	29
			Male	27
Experienced Teachers (G3)	19-25	-	Female	-
			Male	-
	26≤	91	Female	52
			Male	39
Total		261		261

3.2. Instrumentation

The study utilized a diverse set of assessment tools and instruments:

- Interview: Instructors from each group participated in semi-structured interviews. Specific sets of questions tailored to each relevant variable were developed, comprising five questions with an estimated response time of 15-20 minutes per interview.
- Language Assessment Literacy: The participants' assessments of their assessment literacy were collected through a questionnaire developed by Kremmel and Harding (2020). This questionnaire consisted of nine dimensions rated on a 5-point Likert scale, namely: Developing and administering language assessments (14 items), Assessment in language pedagogy (6 items), Assessment policy and local practices (6 items), Personal beliefs and attitudes (4 items), Statistical and research methods (4 items), Assessment principles and interpretation (4 items), Language structure, use and development (5 items), Washback and preparation (4 items), Scoring and rating (3 items).
- AI-aided AL platforms: To implement the training course as well as the teachers' classes, they were introduced to two platforms, Magic School and Edapp. These two platforms are AI-backed AL systems that facilitate content creation, training, evaluation, and feedback-providing activities. These platforms integrate insights from crowdsourcing, language learning, and adaptive learning to bridge the gap between theoretical learning and practical implementation for both teachers and learners.
- Teaching Quality: Teaching professional standards were assessed using a questionnaire with 45 items on a 5-point Likert scale, focusing on four dimensions: Professional knowledge (nine items), Professional practice (17 items), Professional engagement (12 items), and Self-management (seven items). This questionnaire was developed by Manasia, Ianos, and Chicioreanu (2019), with a Cronbach's alpha coefficient estimated at .83.

3.3. Procedure

In the beginning, the language teachers were asked to answer the questionnaires that were provided to them online. Distribution and collection of all answer sheets took 21 days (pre-test). In the next step, the teachers participated in a 50-hour training course, including 10 hours of theoretical training and 40 hours of practical training. After that, the teachers attended the classrooms and taught for 16 sessions. Teachers had the choice to use the Magic School and/or Edapp platforms as AL-assisted ALE tools. In the next step, the questionnaires were again provided to the teachers to express their opinions (post-test). Finally, 45 participants were interviewed and the data was analyzed.

3.4. Design

The current research is based on the combination of quantitative and qualitative methods of data collection, analysis and interpretation to achieve a more comprehensive result (Riazi & Candlin, 2014). To unravel the complexities of AI-aided LAL, the research engages with a diverse set of data sources, encompassing academic literature, educational frameworks, and empirical studies. The qualitative aspect involved in-depth interviews and reflective narratives, capturing the nuanced experiences and perceptions of teachers interacting with AI-aided tools. Quantitative data were gathered through surveys, assessing the varying levels of LAL, factors influencing proficiency, and training needs.

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3.5. Data Analysis

To explore the initial research query on how the ALE influences teachers' LAL, a thorough paired samples t-test was conducted to evaluate shifts in teachers' LAL throughout the study. For the second research query, an ANOVA test was utilized. To gain a deeper understanding of the third research question, which centered on teachers' perspectives on AI-assisted ALE, their viewpoints were carefully classified into pros and cons using MaxQDA.

4. Results

In a bid to explore the extent to which AI-aided ALE course contributes to LAL development, both descriptive and inferential statistics were estimated. Table 2 displays the descriptive statistics.

Table 2. *Paired Samples Statistics*

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	LAL	128.973	261	7.867	.486
	LAL.post	211.042	261	11.708	.723

This table presents the mean and standard deviation of the dependent variable (LAL) divided by the independent variable (time). In this step, to investigate the extent of the significant difference in the effectiveness of the instruction, the significance level was estimated. Table 3 addressed the main results of the paired t-test and if there was a significant difference between the means at different times.

Table 3. *Paired Samples Test*

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
LAL - LAL.post	-82.069	14.153	.876	-83.793	-80.343	-93.684	260	.000

As displayed in the above table, the *t*-value was discovered to be t(260) = 93.684, p = .000. The mean scores of the two LAL tests and the direction of the *t*-value revealed a statistically significant improvement in language teachers' LAL scores following the training program from 128.973±7.86 to 211.042 ±11.708.

In order to address the second research question, both descriptive and inferential statistics were estimated (see Table 4).

Table 4. *Descriptive Statistics of posttests*

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
LAL.post	G1	87	208.689	11.097	1.189	206.32	211.054
	G2	83	213.915	10.712	1.175	211.57	216.254
	G3	91	210.670	12.677	1.328	208.03	213.310
	Total	261	211.042	11.708	.724	209.615	212.469
TQ.post	G1	87	193.620	10.606	1.137	191.360	195.881
	G2	83	199.915	11.752	1.290	197.349	202.481
	G3	91	203.483	11.998	1.257	200.984	205.982
	Total	261	199.061	12.148	.751	197.580	200.542

Then, Leven's test of homogeneity of variances (Sig.=.000) and an ANOVA test were conducted to investigate any differences between the groups in terms of their LAL and TQ.

Table 5. *ANOVA Results*

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	1179.396	2	589.698	4.415	.001
LAL.post	Within Groups	34465.140	258	133.586		
	Total	35644.536	260			
	Between Groups	4415.401	2	2207.701	16.773	.000
TQ.post	Within Groups	33957.618	258	131.619		
	Total	38373.019	260			

The results indicated that that there are statistically significant differences between the groups regarding their LAL score ($F(2,258) = 4.415$, $p = .001$) and TQ score ($F(2,258) = 16.773$, $p = .0000$). The table below illustrating Multiple Comparisons shows groups differences.

Table 6. *Multiple Comparisons with Bonferroni Adjustment*

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LAL.post Bonferroni	G1	G2	-5.226*	1.773	.011	-9.499	-.952
		G3	-1.980	1.733	.762	-6.156	2.195
	G2	G1	5.226*	1.773	.011	.952	9.499
		G3	3.245	1.754	.196	-.981	7.472
	G3	G1	1.980	1.733	.762	-2.195	6.156
		G2	-3.245	1.754	.196	-7.472	.981
TQ.post Bonferroni	G1	G2	-6.294*	1.760	.001	-10.536	-2.053
		G3	-9.862*	1.720	.000	-14.008	-5.717
	G2	G1	6.294*	1.760	.001	2.053	10.536
		G3	-3.567	1.741	.124	-7.763	.628
	G3	G1	9.862*	1.720	.000	5.717	14.008
		G2	3.567	1.741	.124	-.628	7.763

*. The mean difference is significant at the 0.05 level.

Table 6 represents the results of the ANOVA test, which along with descriptive statistics and Post hoc Bonferroni adjustment, demonstrated that the LAL score of G2 was significantly (213.915±10.712) higher than G1 (208.689±11.097, p= .011) and G3 (210.670±12.677, p= .196). Regarding the TQ score, G3 (203.483±11.998) outperformed both G1 (193.620±10.606, p= .000) and G2 (199.915±11.752, p= .124) at the end of the course.
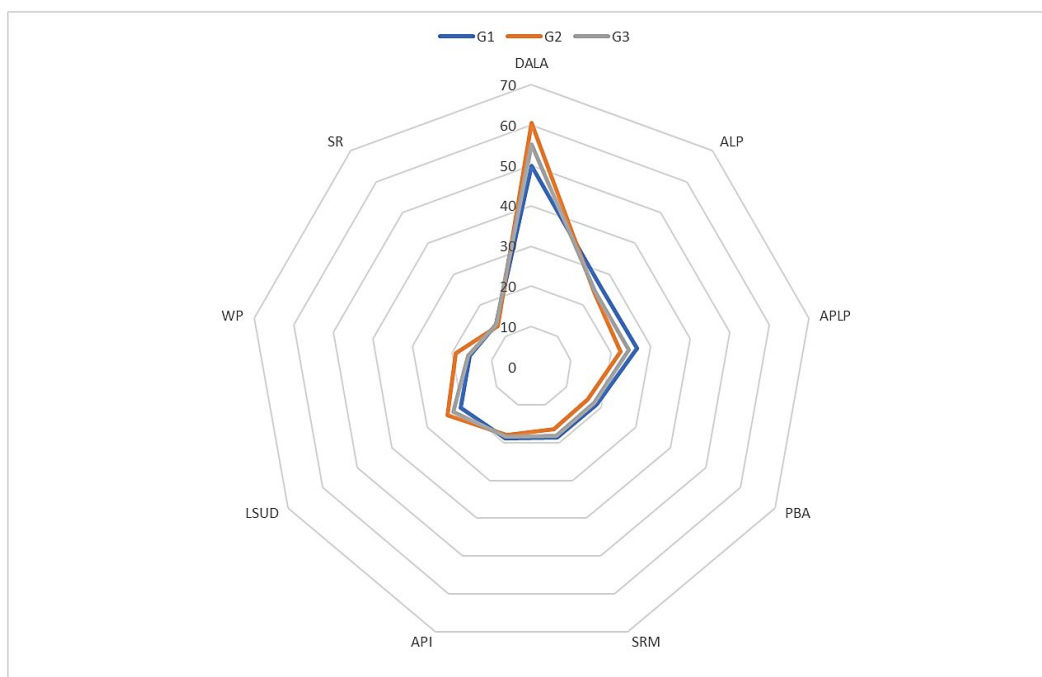
Figure 1. *Areas of Differences in Teachers' LAL*

According to the information in Figure 1, it can be inferred that the main differences in LAL indicators are related to the Development and Implementation of Language Assessments (DALA), Language Structure, Use and Development (LSUD), Assessment Policy and Local Practices (APLP), and Washback and Preparation (WP).
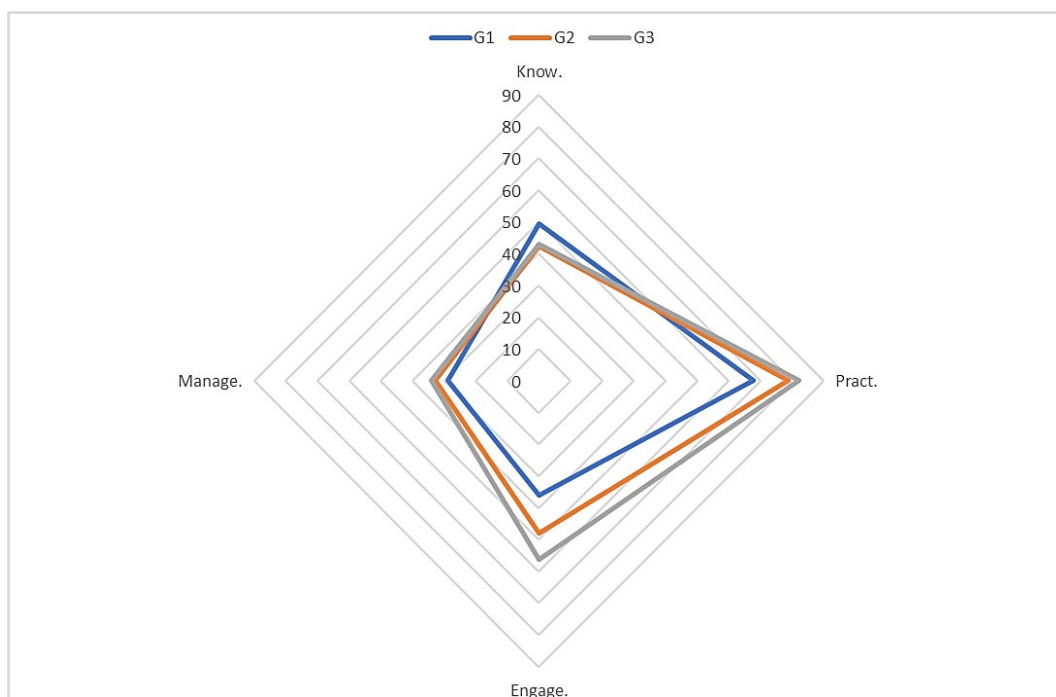

Figure 2. *Areas of Differences in Teachers' TQ*

Figure 2 shows the main difference in TQ indicators in the subcriteria of Professional Knowledge, Practice, and Engagement.

To understand the advantages and disadvantages of using AI-aided ALE in the three groups (RQ3), the common factors and frequent phrases in teachers' comments are categorized in Figure 3.

Figure 3. *Advantages and Disadvantages of AI-aided ALE*

Figure 3 shows the frequencies of language teachers' comments by groups. In this figure, statements number one to 17 showed the advantages while statements number 18 to 27 represented the disadvantages of using AI-aided ALE.

5. Discussion

Recent studies investigated theories and assumptions of assessment methods and strategies and developed criteria and tools. However, most of these studies have neglected to directly examine the needs, knowledge, and skills of learners and the effects of such technological tools. By recognizing these gaps and understanding the necessity of equipping teacher-learners with technological competencies, the need for research focused on increasing the efficiency of these technologies in various aspects of education, including assessment, is evident. In light of this growing demand, the concept of LAL has emerged, which is conceptualized as a framework of dynamic interrelationships and technological literacies related to the triad of teaching, learning, and assessment.

The findings of the first research question showed that the AI-aided ALE course leads to LAL development. The findings from previous research (e.g. Christodoulou & Angeli, 2022; Salas-Pilco, et al., 2022; Schmid & Petko, 2019; Jaeger, 2016; Tammets & Ley, 2023) also illustrated that such approaches in using modern tools, through facilitating instructions, combining educational tools and teaching aids, and facilitating the management of classroom affairs, strengthen Technological Pedagogical Content Knowledge (TPCK), personalized experiences, efficiency, creativity and satisfaction in teachers (Yudi Cahyono, et al., 2023). On the other hand, the findings related to the second question revealed that both the TQ index and the LAL index developed; meanwhile, TQ was higher in Experienced teachers and LAL was higher in Senior teachers than the other two groups. These findings are in line with Ladd and Sorensen (2017),

Coombe, Vafadar, and Mohebbi (2020), and Vogt and Tsagari (2014). These findings also contradict the results of Gore, et al. (2023) and Graham et al. (2020), according to which years of teaching experience do not affect teaching quality. It should be noted that these differences can be due to factors such as the ability of learners and their dispersion in classrooms, the age group of participants and the tools used in each of these researches, or the high level of burnout of beginning teachers in facing modern challenges (Yan, Zhang, & Fan, 2018).

In light of the qualitative insights drawn from this study, reform is necessary in traditional assessments, especially in AI-assisted ALE. It can be inferred that the inadequacies of traditional assessment methods - often teacher-centered methods- do not properly and adequately respond to today's learning needs. In analyzing the benefits of AI-aided ALE, criteria such as increasing assessment accuracy, facilitating individual learning paths and efficient allocation of resources, providing adaptive feedback in real-time, dynamic curriculum alignment, and personal professional development were considered. According to language teachers, this approach helps to effectively identify student needs and enables strategic customization of materials and promotion of collaborative learning. It also causes the development of technological literacy, adapts educational strategies to student progress, and offers various learning styles. However, in addition to these advantages, the use of these new tools causes challenges for teachers, including the potential for fragmentation in language learning, the difficulty in maintaining the connection and coherence of the content, the nature of its implementation time, and the increasing workload for teachers. The doubt that exists in the meantime is the fairness and justice of the assessment in this approach, and the problem that exists in the way of using this modern approach is the adaptability of experienced teachers toward accepting and using it.

Reviewing the opinions expressed in this study, it is necessary to consider the advantages and disadvantages identified in the distinct groups of participants. Novice teachers, with their limited experience, may find the rigor of advanced assessment, individualized learning paths, and adaptive feedback in this approach helpful as it aids their early career development. However, they may struggle with challenges such as fragmentation, limited educational experience and scope of AI, high diversity of individual learning paths, and integration of AI into education, while senior teachers, benefiting from intermediate experience, can use AI-based tools and features to complete professional tasks, allocate resources efficiently, develop professionally, and customize instructional materials. On the other hand, senior and experienced teachers may face increased workload, uncertainty about the fairness and accuracy of assessments, and engagement of all learners. Ambiguities about the accuracy of evaluations in this approach may emerge due to traditional evaluation experience and habituation to traditional feedback delivery processes. Experienced teachers rely on factors such as conscious educational strategies, strategic adaptation to educational progress, and professional empowerment. However, they may face problems such as technology acceptance and adaptation.

Another point is the complex differentiation and interaction caused by the use of AL and related terms, which in the view of teachers is deeply influenced by learning environments and technology (Salas-Pilco, et al., 2022; Wicking, 2022). Wicking (2022) recognized this phenomenon as contextual factors that highlight the dynamic effect of the learning environment. According to them, even teachers who have similar and identical working conditions may show diverse or contradictory attitudes toward the concept of implementing evaluation in these conditions. The other point is the need to pay attention to diversity in the way of expressing, explaining, and using technical-professional terms in different working groups.

In summary, the quantitative findings of this study confirmed the effectiveness of assessment literacy in AI-assisted ALE, and the qualitative results emphasized the importance of applying AI-assisted ALE to language teachers, especially in assessment methods. These findings emphasize the complex landscape of integrating AI into language teaching and the necessity of employing a balanced approach.

6. Conclusion

In this study, the potential of teachers' LAL in the quality of teaching was investigated by examining its application in AI-aided ALE. The design of the treatments was based on the implementation of AI in adaptive systems. The findings of this study shed light on several significant implications of the relationship between AI-aided ALE, LAL, and the quality of teaching, in the context of language teaching-learning:

- Enhancing assessment skills and developing active engagement: Applying AI-aided ALE assists teachers in assessing learners' progress more accurately and easily. In this way, teachers can continuously develop their assessment skills and interact more with learners.
- Flexibility and adjustment in providing content: Adaptive features of AI facilitate the adjustment and implementation of content and activities based on the needs of learners. Learning in such conditions provides the possibility to adjust the content and educational tools based on the needs and abilities of the learners.
- Identifying learners' needs and providing instant feedback: Such educational conditions make it possible to recognize the needs, abilities, and characteristics of each learner and their progress more accurately and provide them with the possibility of receiving feedback individually and confidentially.
- Increasing active participation, engagement, and motivation: Direct connection with students' learning process encourages teachers to participate more actively and effectively in classroom management.
- Challenges in AI-aided ALE Implementation: Several challenges related to the successful implementation of AI learning environments have been identified which require effective solutions and implementation measures. Examining the effects of teaching with the cooperation of AI shows that increasing the active interaction between students and the learning environment is an effective factor in improving their performance. Moreover, improving interaction and integration with AI learning environments creates new possibilities to enhance the educational experience.

Nevertheless, this study showed that AI-aided ALE was a promising approach that can develop a suitable context for enhancing teachers' assessment literacy and consequently, their teaching quality. This study also showed that such an approach can be well combined with other educational approaches and achieve the objectives defined in each of them. It includes dimensions of collaborative learning, real-world applications, continuous professional development, etc.

Despite the findings and implications of the use of AI in ALE, the study had limitations. First and foremost, this study is the first of its kind and needs to be replicated under different conditions and with participants of various years of experience and from different backgrounds. The generalizability of the study findings is restricted due to the specific sampling and design employed. The research focused on English language teachers, and future investigations may consider a more diverse range of disciplines to enhance the applicability of the results across various educational contexts. Future research could address whether the duration of pre-service training, the type of delivery, the tools used, and conditions for technology infrastructure and access, which were specifically designed for this study, affect the quality of teachers' performance.

The AL tools used in this study were common among all groups and this experimental condition was prepared by the researcher, but in reality, teachers may prefer to use different tools. Therefore, further analysis by including different tools may provide a more comprehensive understanding of the real conditions of modern learning. Investigating group differences related to gender, age, and field of study of teachers and language learners can also help in gaining a more comprehensive investigation of the quality of teaching and learning. Another limitation stems from the cross-sectional design employed in this study. A longitudinal design could offer valuable insights into how job readiness, performance, and quality evolve under different circumstances. Longitudinal research could capture variations and changes in teaching, providing a more dynamic perspective on the impact of AI-aided ALE on LAL and its functions — as discussed earlier. Moreover, this study primarily focuses on English language learning. Exploring the potential influences of participants' first or second/third languages on their English learning experiences and outcomes could introduce a more nuanced understanding of the effects observed.

Notes

[1]First note. The results of this study show that the use of adaptive learning environments based on artificial intelligence (AI-aided ALE) can help improve teachers' assessment skills and improve their teaching quality. This technology provides the possibility of adjusting activities and educational content based on the specific needs of learners.

[2]Second note. The main limitation of this study was its sampling and specific design, which only focused on English language teachers. Future research should examine a greater variety of academic fields and different educational contexts to obtain more generalizable results.

Information on Informed Consent or any Data Privacy Statements

Not applicable.

Conflict of Interest

Not applicable.

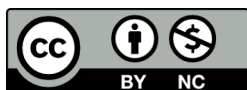**Ethics Board Approval Statements**

Not applicable.

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