Research Paper

Quantitative Research Literacy Among Iranian EFL Teachers at Different Levels of Education: Revelations for Policy Makers and Program Developers

Alireza Zaker*

Assistant Professor, Department of Teaching English and Translation, Karaj Branch, Islamic Azad University, Karaj, Iran

Abstract

English Language Teaching (ELT) practitioners are expected to adopt the role of reflective practitioners, engaging in a thorough and analytical examination of their teaching practice. This is achieved through the undertaking of research, with systematic research being recognized as a crucial endeavor in implementing reflectivity within the ELT field. Concurrently with the proliferation of several novel problems and methodologies in the realm of research within ELT contexts, the act of conducting research in ELT has evolved into a multifaceted endeavor. The data for this study were gathered from 717 English as a Foreign Language (EFL) instructors, consisting of 581 females (81%) and 136 males (19%). The participants included individuals with B.A., M.A., and Ph.D. degrees, with an average age of 25. The Quantitative Research Literacy (QRL) questionnaire, developed by Zaker and Nosratinia (2021), was utilized as the primary instrument for data collection. The utilization of the non-parametric Welch's ANOVA test and the Games-Howell post-hoc technique revealed a statistically significant disparity in the mean score on the QRL measure across participants with Ph.D., M.A., and B.A. degrees. Specifically, Ph.D. level participants exhibited a notably higher average score compared to both M.A. level and B.A. level participants. Additionally, upon conducting Welch's analysis of variance (ANOVA) and applying the Games-Howell post-hoc procedure, it was observed that the participants exhibited the highest level of proficiency in developing research topic knowledge. Conversely, the participants displayed the lowest level of knowledge in data analysis. This study finishes by engaging in a comprehensive discussion of the findings and providing recommendations to enhance the QRL features within teacher training programs.

Keywords: quantitative research, reflectivity, research literacy, teacher training

INTRODUCTION

English as a Foreign Language (EFL) teachers and instructors function as reflective and transformative practitioners who research and explore classroom events and outcomes, according to prevalent trends in TEFL (Kumaravadivelu, 2012; Lightbown & Spada, 2013; Zaker, Nosratinia, Birjandi, & Yazdanimoghaddam, 2019). Teachers should "gather data about their teaching, examine their attitudes, beliefs, assumptions, and teaching practices, and use the information obtained as a basis for critical reflection about teaching," according to Richards and Lockhart's (1994) proposal (p. 1). Additionally, this inquiry is seen as "an appealing way to look more closely at puzzling classroom issues or to delve into teaching dilemmas" (Burns, 2010, p. 6), and it has also been addressed through Action/Classroom Research. For this reason, EFL teachers view the reflective appraisal of their

*Corresponding Author's Email:
zaker@kiau.ac.ir

teaching practices as a crucial tool (Farrell, 2012; Nosratinia & Zaker, 2017).

Everyone agrees that conducting methodical, contextual, and well-designed applied English language teaching (ELT) research can significantly advance pedagogical techniques and ELT practitioners' current understanding of ELT (Farrell, 2012; Jay & Johnson, 2002; Zaker, Nosratinia, Birjandi, & Yazdanimoghaddam, 2020). Moreover, ELT practitioners would be able to break free from the constraints of subjectivity and "discover meaning [they] might otherwise miss" thanks to this critical and self-involved approach (Jay & Johnson, 2002, p. 78).

The fields of pedagogy, curriculum development, assessment, learner variables, and teacher education have all seen significant growth in recent years (Akbari, 2008; Bell, 2003; Ellis, 2010; Fahim & Zaker, 2014; Lightbown & Spada, 2013; Mitchell, Myles, & Marsden, 2013; Nation & Macalister, 2010; Nosratinia & Zaker, 2014; Nosratinia & Zaker, 2015; Pourdana, 2022). Thus, it makes sense that new concerns and methods for conducting applied research in ELT contexts have emerged at the same time (Ary, Jacobs, Sorensen Irvine, & Walker, 2019; Birjandi & Siyyari, 2010; Mackey & Gass, 2015). Furthermore, it appears that advanced research skills are necessary for both TEFL students and professional research- ers to address various pedagogical issues (Blessinger, 2015).

According to Ary et al. (2019, p. 15), applied research is a type of study that "aims to find a solution to a specified practical problem under the conditions in which it appears in practice." The two main methods used to do applied research are quantitative and qualitative approaches (Best & Kahn, 2006; Creswell, 2014).

According to "the nature of the data and philosophical assumptions on which they are based that have led to different terminologies," there are differences between quantitative and qualitative research methodologies (Ary et al., 2019, p. 442).

Philosophically, there are some differences between the epistemological presumptions underlying quantitative and qualitative research.

The positivist premise that reality is made up of facts and causal processes that are visible to scientists only through scientific observation is often reflected in quantitative research.

Conversely, constructivism—the view that realities are created by people rather than observed objectively—tends to be reflected in qualitative research (Springer, 2010, p. 20). Best and Kahn (2006) contend that qualitative research is more interpretive, subjective, and time-consuming than quantitative research, despite linking both to phenomenological inquiry and logical-positivism.

Both qualitative and quantitative approaches are thought to have benefits and drawbacks when it comes to the application of applied research in the ELT field; however, quantitative research appears to offer a stronger foundation for addressing pedagogical questions and evaluating the efficacy of pedagogical strategies (Hadi & Closs, 2016). The present positivist approach to ELT research, which emphasizes objectivity, generalizability, and being criterion-oriented, is what gives rise to this particular privilege (Breen & Darlaston-Jones, 2010). Moreover, while qualitative measures hold immense significance in research, their practicality in terms of necessary resources is questionable (Creswell, 2014).

This benefit also stems from the fact that quantitative research are more objective and useful than qualitative studies as they use dependable instruments and much bigger sample sizes (Hadi & Closs, 2016; Springer, 2010). Larger sample pools undoubtedly improve the generalizability of quantitative study results (Springer, 2010). According to Breen and Darlaston-Jones (2010), p. 67, as a result, quantitative research is "privileged over other forms of enquiry, and other epistemologies, methodologies, and methods remain marginalised within the discipline."

The validity of study findings and the correctness of the strategy used to achieve ELT pedagogical goals can be ascertained by possessing the knowledge of systematic quantitative research, also known as quantitative research literacy (QRL; Zaker & Nosratinia, 2021). However, as this skill/knowledge is mostly

acquired in academic settings, such as graduate and undergraduate courses, investigating the efficacy of various teaching methodologies for enhancing EFL teachers' QRL appears to be both necessary and appropriate.

To far, no systematic study has been conducted to examine and contrast QRL between EFL teachers in the B.A., M.A., and Ph.D. categories. ELT practitioners and researchers whose articles and studies exhibit a multitude of issues, ranging from plagiarism and publication and presentation problems to erroneous study designs, find it extremely difficult to assess the efficacy of teacher training courses and to diagnose the problematic areas of QRL in the absence of this scrutiny (Zaker & Nosratinia, 2021). Thus, this study was carried out with two goals in mind: first, to examine and compare the QRL level among EFL teachers at various educational levels, and second, to investigate the levels of QRL components among these participants. In order to address

this goal, the following research inquiries were developed:

To approach this purpose, the following research questions were formulated:

RQ₁: Is there any significant difference among B.A., M.A., and Ph.D. level EFL teachers in terms of quantitative research literacy?

RQ₂: Is there any significant difference among the levels of quantitative research literacy factors in terms of EFL teachers' performance?

REVIEW OF LITERATURE
Components of Quantitative Research Literacy

The model and instrument of QRL were developed by Zaker and Nosratinia (2021). The following table, offered by Zaker and Nosratinia (2021), presents the validated model of QRL and its underlying factors and sub-factors.

Table 1
The Validated Model of Quantitative Research Literacy Including the Factors and Sub-Factors

	Embeddedness in the Existing Body of Research
Factor 1: Developing the Research Topic	Narrowing Down the Focus of the Study
	Justifying the Significance of the Study
	Practicality Concerns
	Mastery of Quantitative Research Types, Variables, and
Factor 2: Design Knowledge	Measurement Scales
	Research Validity Knowledge
	Sampling Knowledge
Factor 3: Procedural Knowledge	Data Collection Competence
	Implementing Ethics in Research
Factor 4: Data Analysis Knowledge (unidimensional)	

Developing the Research Topic

The process of selecting a suitable research area or topic is a vital aspect of conducting research. Cohen, Manion, and Morrison (2011) emphasize that this selection should be based on criteria such as originality, significance, non-triviality, relevance, topicality, and interest to a broader audience, with the aim of advancing the field (p. 106). Furthermore, it is imperative to address the crucial matter of evaluating both the feasibility and applicability of the aforementioned (L. Cohen et al., 2011). Prior to commencing the actual study, it is

crucial to undertake a comprehensive examination of the extant research literature. This preliminary investigation serves to establish a contextual framework and background that substantiates the execution of the study (Ary, Jacobs, & Sorensen, 2010, p. 62). Additionally, it is recommended that the scope of the study be limited in order to render it "potentially researchable" (Best & Kahn, 2006, p. 33). Additionally, it is important for the researcher to endeavor to substantiate the significance of the "proposed study" (Ary et al., 2010, p. 589).

Design Knowledge

The aspect of QRL that appears to be the most comprehensive is the incorporation of design expertise. First and foremost, possessing knowledge about various types of quantitative research is a crucial element in the process of developing a quantitative research study. This entails having an awareness of the attributes of experimental research, the attributes of quasi-experimental research, and the attributes of descriptive quantitative research (namely correlational and ex post facto). According to Cohen et al. (2011), it has been asserted that research conducted in a "hypothetico-deductive mode" and study employing statistical methods typically begins with the formulation of one or more hypotheses (p. 608). In light of this, it is imperative for the researcher to differentiate between various common types of hypotheses, namely the null hypothesis and the alternative hypothesis.

In order to conduct effective research, it is essential for researchers to possess a sufficient level of proficiency in handling variables and measurement scales. Moreover, it is essential to acknowledge the significance of research validity and the potential dangers it poses within the quantitative research framework (Ary et al., 2010, p. 645; Best & Kahn, 2006, p. 172; L. Cohen et al., 2011, p. 183). Furthermore, within this theoretical framework, researchers primarily focus on a subset of the population that is chosen for the purpose of observation and analysis (Best & Kahn, 2006, p. 13). Therefore, understanding the principles of sampling becomes an additional consideration in the field of design knowledge.

Procedural Knowledge

The initial aspect implicated in this domain is the competence in data collection, which emphasizes the utilization of the most suitable equipment and techniques for gathering and analyzing data, upon which hypotheses can be evaluated (Best & Kahn, 2006, p. 346). In addition, when undertaking research that involves human subjects, it is crucial to take into account the ethical principles and norms that have been established to safeguard the well-being and rights of the participants (Best

& Kahn, 2006, p. 47). Undoubtedly, the paramount significance is in the unwavering commitment to ethical principles while designing and executing research, regardless of whether it is qualitative or quantitative in nature (Ary et al., 2010, p. 590). Moreover, it is imperative to recognize and uphold the inherent rights, dignity, and value of all individuals (Best & Kahn, 2006, p. 50). The AERA guidelines (American Educational Research Association, 1992, p. 24) outline the eleven obligations that researchers have towards participants.

Data Analysis Knowledge

The understanding of data analysis, often known as statistical knowledge, is considered to be a crucial component of quantitative research. The field of data analysis encompasses the examination and interpretation of quantitative data, as well as the evaluation of hypotheses (Best & Kahn, 2006). In a more precise sense, the subject matter pertains to a collection of mathematical methodologies or procedures employed to collect, structure, scrutinize, and elucidate numerical information (Best & Kahn, 2006, p. 354). According to Best and Kahn (2006), possessing knowledge in data analysis is crucial for researchers as it allows them to draw conclusions or make broader statements about populations based on their observations of sample characteristics (p. 441).

ELT Research Courses in Iran

In the Iranian context, research courses for university students in the realm of human science, especially language studies, are limited to one course in each level of education. To be more specific, B.A. M.A., and PhD. students majoring in ELT need to take one research course in each level of education which basically lasts for fifteen sessions of 90-minute classes. These courses are led by the professors, and the ultimate goal seems to be developing students' theoretical research knowledge.

The normal procedure in these classes is going through research books introduced by the university curriculum and taught by the professors, and in these courses, the normal

assessment procedure is summative assessment. Although some students, especially those enrolled in graduate courses, may be asked to carry out research projects, these projects do not usually demonstrate a high level of research validity and authenticity as students lack the required knowledge and competence for carrying out these projects (Zaker & Nosratinia, 2021). However, it is ethically essential to emphasize that in this context some of the professors go the extra mile and function beyond the limitations of the program by exercising their creativity and spending more time and energy in order to develop the students' research knowledge and motivation.

METHOD

Design

This study adopted a descriptive quantitative design (Best & Kahn, 2006) in which participants' QRL was the dependent variable (the main variable of concern in this study) and their education levels functioned as an attribute independent variable (Ary et al., 2019).

Participants

Initially the QRL instrument was administered to 1171 individuals who were selected employing convenience sampling from Aale Taha University, Allameh Tabataba'i University, Islamic Azad University (Central Tehran and South Tehran branches), and Shahid Beheshti University. These participants were male and female (932 or 79% females; 248 or 21% males) B.A., M.A., and Ph.D. students who majored in English language teaching, English translation, and English literature. The age range of the participants was 18 to 58 (M_{age} = 25). Out of 1171, the data collected from 454 participants demonstrated poor care in answering, bringing the ultimate number of participants to 717 (581 or 81% females; 136 or 19% males) EFL teachers.

Instrumentation

The Quantitative Research Literacy Scale *The QRL scale, as established and verified by Zaker and Nosratinia (2021), is a Likert-type questionnaire consisting of 50 items. This questionnaire aims to assess QRL b y e x a -*

mining four overarching factors and nine sub-factors. The- se factors represent the primary domains of QRL, namely Developing Research Topic Knowledge (consisting of 9 items), Research Design Knowledge (consisting of 19 items), Procedural Knowledge (consisting of 13 items), and Data Analysis Knowledge (consist- ing of 9 items).

The participants are expected to respond on the basis of a six-point Likert scale, ranging from "*strongly disagree*" (1) to "*strongly agree*" (6), and the allocated time for providing the responses is 25 minutes. The total obtained scores could range from 50 to 300. In the validation study, Zaker and Nosratinia (2021) report numerous measures taken for supporting the reliability and validity of this instrument; some of these measures are model development, expert review, initial piloting, revision, administering the instrument, conducting Exploratory Factor Analysis, and finally conducting Confirmatory Factor Analysis, using the MPlus software. The calculated reliability/internal consistency index for the QRL scale in this study was estimated to be 0.93 using Cronbach's alpha coefficient.

Procedure

To facilitate the execution of this study and accomplish its relevant objectives, a series of procedures were implemented, which are elaborated upon in this part. In order to conduct this study, the necessary formal approvals were obtained from the administrators of the respective universities attended by the participants. At the commencement of data collection, the participants were provided with information regarding the researchers' background and identity, the research objectives, and the primary attributes of the study. After employing the convenience sampling strategy to select the participants, they were duly notified that their involvement in this study would be entirely voluntary. Furthermore, they were granted the freedom to withdraw from participation at any given moment, without incurring any negative consequences, and without having to provide a specific justification. Furthermore, the participants were duly notified

that the data provided by them would be handled with utmost confidentiality.

Subsequent to this, and prior to completing the questionnaire, the participants were presented with a comprehensive elucidation regarding the instrument and the procedure for responding. Additionally, they were apprised that the responses they provide would not have any impact on their academic grades or how they would be treated. The participants were allotted a duration of 25 minutes to furnish their responses, with the researchers being present during the administration phase to address any potential issues. Subsequently, the questionnaires that were gathered were examined to assess the adequacy and comprehensiveness of the care provided during the process of responding to them. As a consequence, a total of 454 questionnaires were deemed ineligible for in-

clusion, leaving a final sample size of 717 data sets for the subsequent data analysis stage.

RESULTS

Answering the First Research Question

This research question concerned the comparison of participants with different education levels in terms of QRL. To address this purpose, the following research question was formulated:

> **RQ1:** *Is there any significant difference among B.A., M.A., and Ph.D. level EFL teachers in terms of quantitative research literacy?*

In order to answer this question, the data were to be analyzed using a single-factor/one-way between-groups Analysis of Variance (ANOVA) with post-hoc tests. The pertinent descriptive statistics are reported in Table 2.

Table 2

Descriptive Statistics of Quantitative Research Literacy in the Education Groups

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
B.A.	630	160.89	29.94	1.19	158.55	163.24
M.A.	65	201.23	38.29	4.75	191.74	210.72
Ph.D.	22	251.41	29.08	6.2	238.52	264.30
Total	717	167.33	36.08	1.35	164.68	169.97

As reported in Table 2, the Ph.D. level participants ($M = 251.41$, $SD = 29.08$) obtained considerably higher scores than the M.A. level participants ($M = 201.23$, $SD = 38.29$) which in turn outperformed the B.A. level participants ($M = 160.89$, $SD = 29.94$). This was a preliminary indication that the participants were not homogenous in terms of quantitative research literacy. The mean scores of quantitative research literacy are also presented in Figure 1 in a comparative manner.
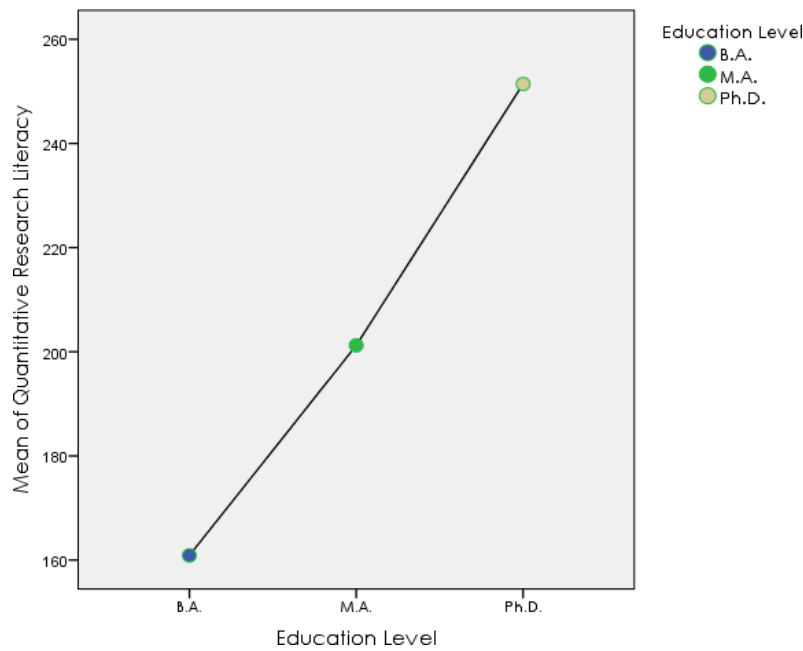
Figure 1
Line chart of quantitative research literacy mean scores in the three education levels

Prior to running the standard ANOVA test, it was essential to check the existence of homogeneity of variance, especially due to the fact that there were different numbers of participants in the three groups of education (Tabachnick & Fidell, 2014). This was taken care of through running Levene's Test of Homogeneity of Variances (Table 3).

Table 3
Levene's Test of Homogeneity of Variances in Education Level Groups

Quantitative Research Literacy			
Levene Statistic	df1	df2	Sig.
3.531	2	714	.030

As reported in Table 3, checking the results of Levene's Test of Homogeneity of Variances indicated that the assumption of homogeneity of variance was not met, *Levene's F* (2, 714) = 3.53, *p* = .03. Consequently, it was no longer legitimate to run the standard ANOVA. Instead, Welch's ANOVA Test was conducted (Table 4).

Table 4
Welch's ANOVA Test for the Education Level Groups

Quantitative Research Literacy			
	Statistic[a]	df1	df2	Sig.
Welch	129.67	2	45.69	**.000**

[a]Asymptotically F distributed

According to the results presented in Table 4, it was concluded that there were statistically significant differences between pairs of education level groups in terms of QRL, *Welch's F* (2, 45.69) = 129.67, *p* = .0005, ω^2 = .2641 representing a large effect size). Moreover, it was concluded that approximately 26% (ω^2 = .2641) of the total variance in quantitative research literacy is accounted for by the independent variable (three education levels; J. Cohen, Cohen, West, & Aiken, 2015). Thence, it was critical to conduct a pairwise comparisons post-hoc test in order to determine which pairs of the three education levels differed sig-

nificantly. For this purpose, the Games-Howell   post-hoc procedure was conducted (Table 5).

Table 5
Games-Howell's Post-Hoc Test for the Education Level Groups

		Quantitative Research Literacy				
(I) Education Level	(J) Education Level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
B.A.	M.A.	-40.337*	4.897	.000	-52.06	-28.62
	Ph.D.	-90.515*	6.313	.000	-106.34	-74.69
M.A.	B.A.	40.337*	4.897	.000	28.62	52.06
	Ph.D.	-50.178*	7.809	.000	-69.07	-31.29
Ph.D.	B.A.	90.515*	6.313	.000	74.69	106.34
	M.A.	50.178*	7.809	.000	31.29	69.07

*The mean difference is significant at the 0.01 level. Bonferroni adjustment implemented.

As reported in Table 5, it was indicated that Ph.D. level participants ($M = 251.41$, $SD = 29.08$) had a significantly higher average score on quantitative research literacy than M.A. level participants ($M = 201.23$, $SD = 38.29$). Furthermore, M.A. level participants ($M = 201.23$, $SD = 38.29$) scored significantly higher than the B.A. level participants ($M = 160.89$, $SD = 29.94$). The effect sizes for these two significant effects were 1.475 and 1.173, respectively. These values indicated large effect sizes (J. Cohen, 1988).

Answering the Second Research Question

This research question concerned the comparison of the overall estimated performance of the participants on the four factors of quantitative research literacy. To address this purpose, the following research question was formulated:

RQ₂: Is there any significant difference among the levels of quantitative research literacy factors in terms of EFL teachers' performance?

In order to answer this question, it was essential to employ the standardized scores which could fluctuate within the same range (for the sake of valid comparison). The data were to be analyzed using a single-factor/one-way between-groups Analysis of Variance (ANOVA) with post-hoc tests. The pertinent descriptive statistics are reported in Table 6.

Table 6
Descriptive Statistics of Different Factors of Quantitative Research Literacy

		Standardized Values				
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Developing the Research Topic -Average	717	4.758	.66	.025	4.71	4.81
Design Knowledge - Average	717	2.705	1.05	.04	2.63	2.78
Procedural Knowledge - Average	717	4.504	.94	.035	4.43	4.57
Data Analysis Knowledge - Average	717	1.617	1.04	.039	1.54	1.69
Total	2868	3.396	1.6	.029	3.34	3.45

As reported in Table 6, developing the research topic ($M = 4.758$, $SD = .66$) has obtained a considerably higher mean value than procedural knowledge ($M = 4.504$, $SD = .94$) which in turn has placed considerably higher than design knowledge ($M = 2.705$, $SD = 1.05$). Data analysis knowledge has obtained the lowest mean score ($M = 1.617$, $SD = 1.04$). This is a preliminary indication that the factors are not homogenous in terms of EFL teachers' overall performance. The mean scores of the four factors of quantitative research literacy are also presented in Figure 2 in a comparative manner.
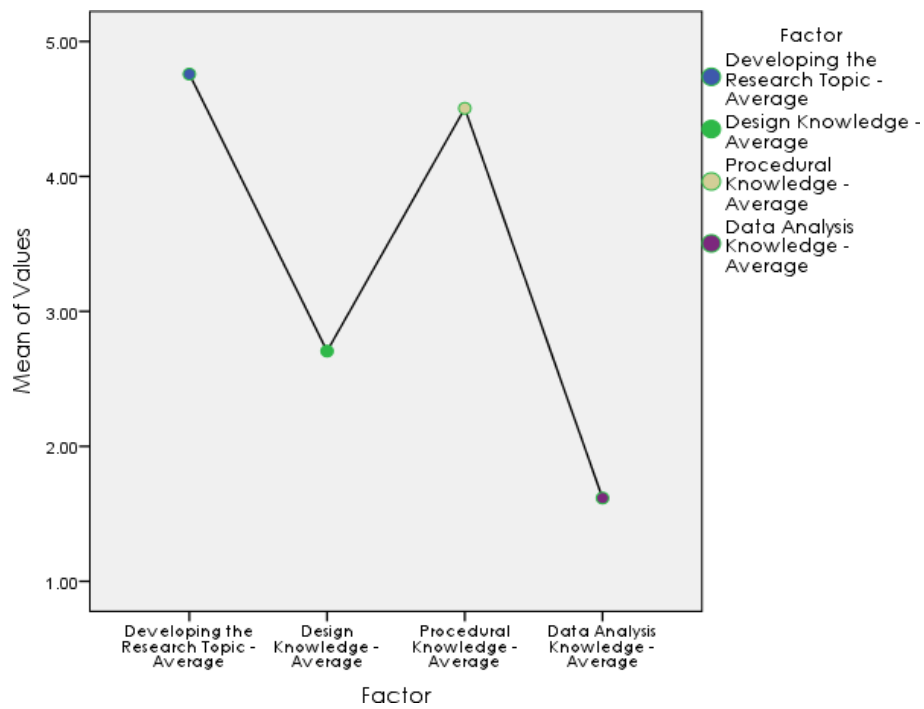
Figure 2
Line chart of mean scores of the four factors of quantitative research literacy.

Prior to running the standard ANOVA test, it was essential to check the existence of homogeneity of variance (Tabachnick & Fidell, 2014). This was taken care of through running Levene's Test of Homogeneity of Variances (Table 7).

Table 7
Levene's Test of Homogeneity of Variances Among Four Factors

Standardize Values			
Levene Statistic	df1	df2	Sig.
43.874	3	2864	.000

As reported in Table 7, checking the results of Levene's Test of Homogeneity of Variances indicated that the assumption of homogeneity of variance was not met, *Levene's F* (3, 2864) = 43.874, *p* = .0005. Consequently, it was no longer legitimate to run the standard ANOVA. Instead, Welch's ANOVA Test was conducted (Table 8).

Table 8
Welch's ANOVA Test for the Four Factors or Quantitative Research Literacy

	Statistic[a]	df1	df2	Sig.
Standardized Values				
Welch	1932.477	3	1557.627	.000

[a]Asymptotically F distributed

According to the results obtained in Table 8, it was concluded that there were statistically significant differences between pairs of factors in terms of participants overall performance, Welch's F (3, 1557.63) = 19332.477, p = .0005, ω^2 = .5739 representing a large effect size). Moreover, it was concluded that approx-imately 57.39% (ω^2 = .5739) of the total variance in the obtained scores is accounted for by the independent variable (the four factors; J. Cohen et al., 2015). Thence, it was critical to conduct a pairwise comparisons post-hoc test in order to determine which pairs of the four factors differed significantly. For this purpose,

the Games-Howell post-hoc procedure was conducted (Table 9).

Table 9
Games-Howell's Post-Hoc Test for the Four Factors or Quantitative Research Literacy

		Standardized Values Games-Howell				
(I) Factor	(J) Factor	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
DT	DK	2.05244*	.046	.000	1.93	2.17
	PK	.25403*	.043	.000	.14	.36
	DAK	3.14117*	.046	.000	3.02	3.26
DK	DT	-2.05244*	.046	.000	-2.17	-1.93
	PK	-1.79842*	.052	.000	-1.93	-1.66
	DAK	1.08873*	.055	.000	.95	1.23
PK	DT	-.25403*	.043	.000	-.36	-.14
	DK	1.79842*	.052	.000	1.66	1.93
	DAK	2.88715*	.052	.000	2.75	3.02
DAK	DT	-3.14117*	.046	.000	-3.26	-3.02
	DK	-1.08873*	.055	.000	-1.23	-.95
	PK	-2.88715*	.052	.000	-3.02	-2.75

Note. DAK = data analysis knowledge; DK = design knowledge; DT = developing the research topic; PK = procedural knowledge.
*The mean difference is significant at the 0.05 level

As reported in Table 9, it was indicated that developing the research topic (M = 4.758, SD = .66) had a significantly higher average score than procedural knowledge (M = 4.504, SD = .94). Furthermore, procedural knowledge (M = 4.504, SD = .94) placed significantly higher than research design knowledge (M = 2.705, SD = 1.05). Finally, research design knowledge (M = 2.705, SD = 1.05) was significantly higher than data analysis knowledge (M = 1.617, SD = 1.04).

The effect sizes for these three significant effects were 0.3127, 1.8052, and 1.0411 respectively. These values indicated medium-to-large, large, and large effect sizes respectively (J. Cohen, 1988).

To assist in gaining a straightforward and omprehensive understanding of the obtained results, Figure 3 presents the three-dimensional chart of standardized scores on the factors and quantitative research literacy categorized based on education level.
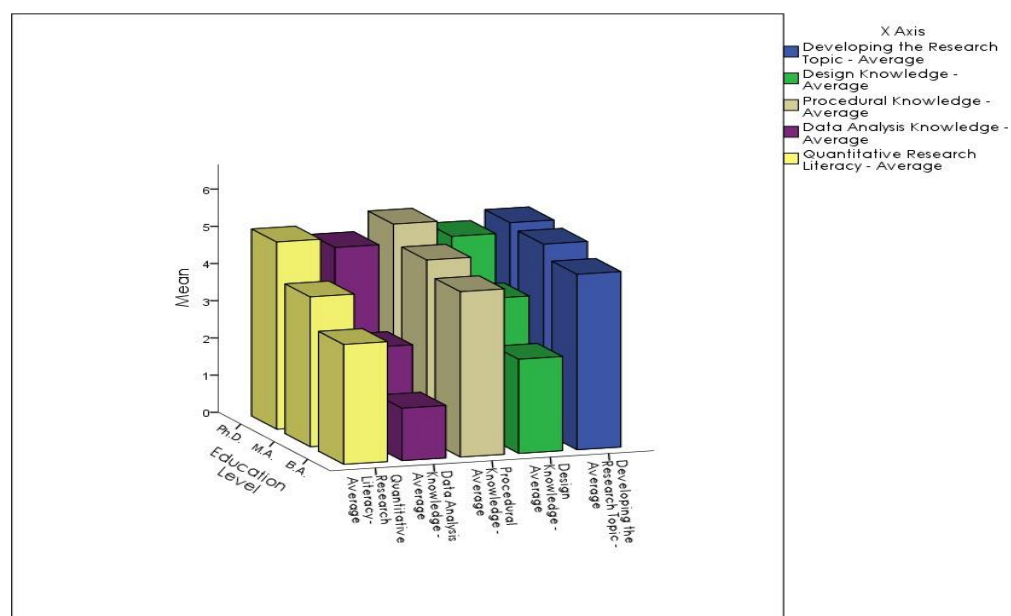

Figure 3
Comparative three-dimensional chart of standardized scores on the factors and quantitative research literacy categorized based on education level

DISCUSSION

Engaging in a methodical, contextually grounded, and carefully planned research in the field of English Language Teaching (ELT), whether it is qualitative or quantitative in nature, is widely acknowledged to have a substantial impact on the current knowledge base of ELT practitioners and the advancement of pedagogical strategies (Zaker & Nosratinia, 2021; Zeichner, 1999). As stated by Springer (2010), the process of doing research involves the acquisition of knowledge through deductive and inductive reasoning, as well as the use of the scientific method. This process is guided by several fundamental principles, including empiricism, conditionality, precision, parsimony, objectivity, and theoretical motivation (p. 26). Furthermore, the implementation of research in language classrooms has the potential to enhance the independent professional development of Teaching English as a Foreign Language (TEFL) practitioners (Paul & Elder, 2008; Scharle & Szabo, 2000). Due to the incorporation of numerous novel elements in the practice of Teaching English as a Foreign Language (TEFL), the undertaking of research in this domain has become increasingly complex. Currently, there is a noticeable rise in the occurrence of several novel problems and methodologies in doing research within the field of English Language Teaching (ELT; Mackey & Gass, 2015). Consequently, it appears that English as a Foreign Language (EFL) instructors necessitate proficient research abilities, which may be acquired through suitable training, to effectively tackle various pedagogical concerns (Blessinger, 2015). Based on the aforementioned premises, it is reasonable to assert that a significant obligation of teacher training programs is to equip English Language Teaching (ELT) instructors with the necessary skills to effectively undertake structured and methodical research.

The current study aimed to assess and compare the extent of QRL across various educational levels, in order to facilitate a comprehen- sive discussion and evaluation of the effec- tiveness of these educational programs in enhancing students' QRL skills. In order to accomplish this, the researchers utilized the validated 50-item questionnaire of QRL within a sample population consisting of 717 English as a Foreign Language (EFL) teachers who possessed varying degrees of education, namely Bachelor of Arts (B.A.), Master of Arts (M.A.), and Doctor of Philosophy (Ph.D.). The primary study inquiry was to the examination of QRL across students pursuing Bachelor's, Master's, and Doctoral degrees. To address this topic, a one-way analysis of variance (ANOVA) with a between-groups design was employed. However, due to the violation of the premise of homogeneity of variance, the non-parametric option, Welch's ANOVA test, was used to address the first research issue.

Based on the findings shown in Table 4, it can be inferred that there exist statistically significant disparities among various education level groups with respect to QRL. Furthermore, approx- imately 26% of the overall variability in QRL may be attributed to differences in education levels. Furthermore, the utilization of the Games-Howell post-hoc technique revealed a statistically significant disparity in the mean score of quantitative research literacy between participants with a Ph.D. and those with an M.A. degree. In addition, it was observed that participants at the M.A. level achieved notably higher scores compared to those at the B.A. level. Based on the findings presented, a plausible argument can be made that the academic levels within the scope of this study exert a direct influence on the students' QRL levels. Moreover, it is observed that higher educational levels are positively correlated with elevated levels of QRL. In alternative terms, the various levels of programs have demonstrated the capacity to generate notable disparities among students, potentially serving as a partial indicator of the programs' efficacy (Mitchell et al., 2013).

Consequently, it was justifiable to conduct a comparative analysis of the mean levels of the four components of QRL among the participants, thereby enabling the identification of their respective regions of QRL that exhibit the lowest and highest proficiency. The data

was analyzed using Welch's ANOVA (Table 8), revealing statistically significant differences between pairs of factors with respect to the overall performance of the individuals. Additionally, the Games-Howell post-hoc process revealed that the average score for developing the study topic was substantially higher than that of procedural knowledge. Moreover, it is worth noting that procedural knowledge exhibited a considerably greater level of prominence in comparison to research design knowledge. Ultimately, there was a notable disparity in the level of proficiency in study design knowledge and data analysis expertise.

Based on the findings, it was determined that the participants exhibited the highest level of proficiency in developing their knowledge of the research issue. Conversely, the participants exhibited a comparatively lower level of proficiency in the domain of data analysis knowledge. Hence, it may be argued that the educational programs examined in this study have not adequately prioritized the development of students' data analysis skills, which are essential for doing research and comprehending research publications (Best & Kahn, 2006; Creswell, 2014).

CONCLUSION

In parallel with the increasing acceptance of the constructivist theory of cognitive and mental development (Ashton-Hay, 2006; Zaker, 2016), there appears to be a growing emphasis in the field of English Language Teaching (ELT) on the active intellectual involvement of ELT practitioners in pedagogical activities (Farrell, 2012; Kumaravadivelu, 2012; Nosratinia & Zaker, 2017). As a result, engaging in a thorough and analytical examination of teaching practices has become a crucial element in the field of teacher education (Akbari, 2008; Nosratinia & Zaker, 2017). According to Farrell (2012) and Jay and Johnson (2002), the act of doing research has the potential to greatly enhance the knowledge and comprehension of English Language Teaching (ELT) practitioners in relation to ELT itself, as well as aid in the advancement of pedagogical strategies.

The scope of the current investigation was restricted solely to quantitative research. Despite the diverse nature of research in the field of human science (Ary et al., 2019; Best & Kahn, 2006), quantitative research has been deemed an essential and vital topic of study (Hadi & Closs, 2016). The issue under consideration is closely related to the foundation of ELT research in positivism, which emphasizes the importance of objectivity, generalizability, and adherence to criteria (Breen & Darlaston-Jones, 2010; Springer, 2010). It is important to note that while qualitative and quantitative studies are conceptually distinct, there are shared rules and principles that apply to both approaches (e.g., ethical principles; Best & Kahn, 2006). Therefore, evaluating proficiency in quantitative research may partially reflect an individual's overall research literacy, including qualitative research literacy.

Without a doubt, a primary obligation of academic teacher training programs is to provide ELT instructors with the necessary skills to effec- tively carry out structured and methodical research. Based on this underlying assumption, the main aim of the current study was to assess and analyze the extent of QRL across various educational levels. This investigation sought to facilitate a comprehensive discussion and evaluation of the effectiveness of these educational programs in fostering students' QRL skills. Based on the findings, it was determined that there existed statistically significant disparities among various education level cohorts with respect to QRL and its four distinct components or dimensions. Hence, a plausible contention can be made that the academic levels within the framework of this investigation exert a direct influence on the students' QRL levels, with greater educational levels being correlated with elevated QRL levels. In alternative terms, it can be posited that the programs implemented at various educational levels have demonstrated the capacity to provide noteworthy outcomes among students, hence potentially serving as an indication of the programs' efficacy (Mitchell et al., 2013).

Furthermore, upon analyzing the data, it was observed that there were statistically significant variations between different pairs of QRL factors with regards to the overall performance of the participants. It was deduced that the participants exhibited the highest level of proficiency in developing their research topic knowledge. Conversely, it was observed that the participants exhibited the least proficiency in the domain of data analysis expertise. Hence, it is justifiable to assert that the educational programs examined in this study have not adequately prioritized the development of students' data analysis skills, which are essential for doing research and comprehending research publications (Best & Kahn, 2006).

In order to address the identified deficiency among university graduates, as evidenced in this research, it is advisable for English as a Foreign Language (EFL) students at various academic levels to actively pursue the enhancement of their data analysis skills by enrolling in statistics courses and engaging in self-directed study. In the latter scenario, it is recommended to consult the SPSS Survival Manual: A Step By Step Guide to Data Analysis Using SPSS Program (6th ed.) authored by Pallant (2016), since it is regarded as a dependable academic resource for further study. It is recommended to utilize the textbook "Using Multivariate Statistics (6th ed.)" authored by Tabachnick and Fidell (2014) for a more advanced understanding. However, in the context of university courses, there appears to be a pressing necessity to revise the content and objectives of these courses in order to equip students with enhanced proficiency in quantitative reasoning and data analysis. The implementation of the CAPR technique (Zaker et al., 2019, 2020) in Research courses can be considered a valid modification that has demonstrated its effectiveness in enhancing participants' understanding of QRL and data analysis.

Considering the focus, design, and limitations of this study, other researchers are recommended to:

- Replicate this study with an equal number of male and female participants, so that gender might not limit the generalizability of the findings;
- Employ pure/simple random sampling while replicating this study in order to enhance the validity of the findings;
- Replicate this study employing some qualitative instruments and employing triangulation in order to increase the validity and reliability of the results and interpretations; and
- Estimate and inspect the cognitive and mental capacities of the participants simultaneous with estimating their QRL levels. Estimate and inspect the cognitive and mental capacities of the participants simultaneous with estimating their QRL levels.

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Biodata

Dr. Alireza Zaker is a Full-time Assistant Professor of TEFL at Islamic Azad University (IAU), Karaj Branch, Karaj, Iran. He received his Ph.D. in TEFL from IAU, Science and Research Branch, Tehran, Iran. Over the past few years, he has been teaching Advanced Research, Language Assessment, Language Teaching Methodology, Language Learning Theories, Teaching Practicum, and Article Writing courses at IAU and some state universities in Iran. His specific areas of ELT research include Language Assessment and Research Methodology.
E-mail: *zaker@kiau.ac.ir*