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Effects of TPACK-Based Blended Learning on Iranian EFL Teachers' Reflection and Critical Thinking

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Abstract
Successful technology integration initiatives hinge on the skills and knowledge of teachers to effectively implement technology in classroom teaching. The effect of technology in blended learning can be maximized if the three aspects of content, pedagogy, and knowledge are well incorporated. Technological Pedagogical Content Knowledge (TPACK) offers a framework for teacher knowledge to combine technology and teaching successfully. Using digital tools in TPACK to understand EFL teachers' skills and ability levels is considerably important. This study examined the impact of blended learning according to the TPACK framework presented by Mishra and Koehler (2006) on critical thinking and reflection. To this end, 60 EFL teachers were selected from among 100 EFL teachers based on their OPT scores. They were asked to participate in a pre-post-test design experiment. The data were gathered from the EFL teachers through three questionnaires including the TPACK questionnaire, reflective questionnaire, and critical thinking questionnaire. During the 12 sessions of intervention, the experimental group experienced BL instruction based on the TPACK model, while the control group went through traditional face-to-face instruction. The teachers took the critical thinking and reflection questionnaires in the first and last sessions. To analyze the data, independent and paired sample t-tests were conducted. Data analyses revealed that blended-learning training instruction based on TPACK had a statistically significant influence on Iranian EFL teachers' reflection and critical thinking. The findings have implications for EFL teacher educators, school administrators, and other stakeholders to be encouraged to develop TPACK-based professional programs for EFL teachers.

Keywords: Critical thinking, Reflection, Technological Pedagogical Content Knowledge (TPACK)

INTRODUCTION

"Educational technology" is the inclusion of analog or digital tools (Plair, 2010) and application of "information and communications technology" (ICT) like different simulation and animation software in education process so as to smooth the process of teaching and learning. As Ertmer and Ottenbreit-Leftwich (2010) declared, effective teaching means the teaching in which appropriate ICT sources is used as a meaningful educational equipment to boost learners' understanding. Teachers' ability in integrating technology in learning and teaching process would lead to effective teaching (Othman & Lukman, 2011).

According to Gupta et al., (2011) technology has a social role, which can transform society simultaneously through the manipulation of symbolic or physical tools and acculturation. Technology fills the gap between theory and practice in pedagogy. This view is also confirmed by Madden (2012); he declared that using smart phone could increase content delivery and

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learners' focus on learning process. Besides, Technology enables teachers to generate transformative learning through using constructive learning and using technology in their education process. Technology could be used in various processes such as the analysis, decision-making, and increasing teaching techniques (Means et al., 2009).

Technology integration in academic settings is connected with productivity. Likewise, in education, technology functions as an aid to support teachers to accomplish comprehensive teaching and develop brain-based learning (Knight & Elliott, 2009). Researchers (Knight & Elliott, 2009) confirmed the positive effect of technology on rising students' understanding and motivation.

Blended Learning

Blended Learning (BL) is not a new concept; BL originated from the primary form of distance learning, which first appeared as mail order courses which started began more than a century ago. In spite of its durability, distance-teaching status is considered suitable but of lower quality compared to the traditional teaching method. This status carried over into virtual and BL when these were instituted for the first time. Virtual and BL, especially in the early days, were regarded as lower quality compared to situations in which the instructor teaches the students in the physical space without any virtual teaching element (Means et al., 2009).

BL is the blend of online and face-to-face format of learning into a single learning situation (AlKhaleel, 2019). BL is a basic transformation, which changes the instruction method as instruction format. Furthermore, Akyüza (2009) called BL distance education systems the "third generation." The first one was mail, radio, and TV utilization in a one-way educational delivery system. The second generation was single-tech distance education, in which teaching was conducted utilizing a computer or web. The third generation is described as the blending of face-to-face learning into online learning by means of technologies.

The "American Society for Training and Development" considered BL as one of the best ten trends in emerging the information delivery industry. BL has been a gradually emerging trend; it is the latest step in the history of technology-based instruction (Graham et al., 2013).

BL is the collaboration of various components including the hardware and software, the course design, the organizations, and all their preconceptions, budgets and timetables, the learners and their pre-conceived ideas and experiences, and the teachers and faculty. All of these components have to incorporate and interact effectively in the BL course to have a positive and useful experience (Miller et al., 2004).

Although the improvement in technology and its integration into the learning process enable teacher to the conduct of online classes more easily, record the presented lectures, and assign submission, etc. (Al Lily et al., 2020; Al-khresheh, 2021), cause a challenge for many instructors (So & Kim 2009). Besides digital technologies, technical competencies have also appeared. In other words, using technologies in pedagogical contexts requires knowledge and skills. Teachers need to be prepared for using BL (Kramarski & Michalsky, 2010)

TPACK Model

Teachers are required to be prepared for education in new era; they need to be capable of implementing technology in their teaching process. Four main factors should be observed in integrating technology in education, including aspects of knowledge, content, pedagogy, and technology (Mishra & Koehler, 2006). Besides technical competencies and digital technologies have also appeared which entails having ability and knowledge in utilization of technology in order to prepare comprehensive learning. According to Kramarski and Michalsky (2010), teachers are not well prepared in using subject-specific of ICT, and there is a lack of theoretical framework.

Teachers need the technological pedagogical content knowledge (TPACK) in order to effectively and adequately integrate ICT in their classrooms (Papanikolaou, 2014). As Papanikolaou (2014) declared, the TPACK framework, as an integrative and transformative knowledge, reflected on the challenge from focusing on technological knowledge in many

ICT educational courses which are implemented separately from teachers' content matter, it is vital for instructors to know the nature of knowledge and inquiry in various areas.

Recently, educational technologists maintained that the education integration of technology are affected by the content domains in which they are used. For instance, the teacher knowledge for integration of technology in a science class is different from that of a social studies class (Qasem & Viswanathappa 2016).

Consequently, Koehler and Mishra (2005) introduced the total package as TPACK that lies on, learning by design seems to be an operative educational technique for developing profound understandings of the compound web of associations among content, technology and education and the settings in which they function. TPACK framework is the collaboration of three primary formats of knowledge, include Content Knowledge (CK), Pedagogy Knowledge (PK), and Technology Knowledge (TK).

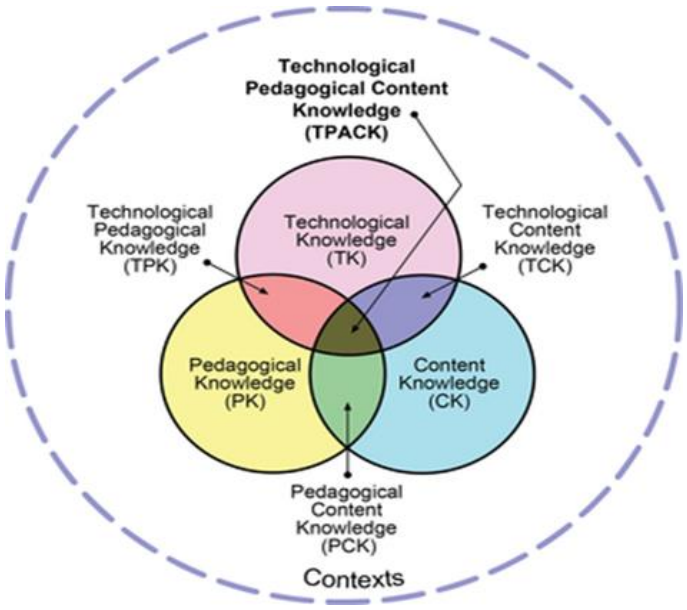

Figure 1

Content pedagogical technological knowledge (Mishra & Kohler, 2006)

Teachers' Reflection and Critical Thinking

The construction of EFL teachers' TPACK is based on reflection, which paves the way for teachers' self-regulation, self-evaluation, and self-orientation as inner processes of reflection. Mishra and Koehler (2006) confirmed that reflection help teachers to be aware of what they already identify and what they are required to learn, to set aims for learning process, to carry out the designed action plan, to analyze the results, and to set plans for further progress.

Aghaei and Jadidi (2013) noted that in general, reflective teaching involves thinking about the way one's teaching and the cognition involved happen before teaching and it clears itself as planning, then after the teaching evaluation and simultaneous to the teaching as reflection in action involving changes to or adjustment of some of the possibility to progress. Aghaei and Jadidi (2013) mentioned that reflective practice is thinking about what we do, what we work and what we don't do, and logics about our teaching and that of others'. Minott (2009) defined reflection as a careful thought, it is critical research, and critical thinking about past, present, and future action of teaching then make decision.

However, designing and implementing a technologically oriented EFL course demand 'thinking out of the box' and reconsidering emerging learning and instructional EFL trends in educational environments, which are constantly shaped by digital advances. In other words, teachers need to develop their critical thinking skills to reach an orchestration of digital EFL instructional patterns and classroom arrangements. Critical thinking encompasses imparting knowledge through reasoning, analyzing, and problem-solving, as well as decision-making. There has been a strong acceptance about the learnability of critical

thinking over time through reflection on personal development and professional growth (Van Gelder, 2005).

According to Halpern (1997), critical thinking is purposeful, goal-directed reasoning with a core evaluation component. Thinking critically, whatever the definition, includes evaluating the outcomes and directing thinking as it emphasizes on the desired result. According to Kalman (2005), critical thinking is equated with logical thinking, analytical thinking, creative or higher-level thinking. Accordingly, critical thinking can be considered as a reflexive, open, evaluative higher-level thinking process assisting EFL teachers actively process new data and create their knowledge in general and TPACK in particular.

Developing critical thinking ability would contribute in to acquiring creative, communication, and self-evaluative skills for construction of their professional skills through life-long learning. From a pedagogical point of view, critical thinking is an active, interactive, creative, and reflexive understanding that teachers could find personal priorities, feel more responsible, solve their immediate problems, gain self-control, be open to modern ideas and solutions, communicate and actively listen, and see connections as well (Yeh et al., 2017).

Literature Review

At first, BL was appeared at the beginning of the 21st century and become popular in higher education. It was considered as the mixture of both technology-mediated and face-to-face pedagogy (Bolandifar 2017). Lastly, BL appeared in English language teaching and learning field as an enabling engagement, abridging the evaluation process, providing the reference, increasing students' collaboration to improve their language learning skills (Whittaker 1976).

Furthermore, BL by use of educational related techniques boost face-to-face communication of teachers and students. BL has been used widely nowadays, in which a lot of amounts of seating time in class is replaced by online actions involving students in accomplishing course goals (Bock et al., 2018). In BL, 29 percent of learning materials are presented through face-to-face activities while 30 to 79 percent are online activities. BL is a careful blend of online learning aspects and face-to-face experience into a single learning method; it changes the teaching and learning methods as instruction format. It is confirmed the effectiveness of integrated teaching in language learning contexts. In other words, although they confirmed the effectiveness of BL, they emphasized on the importance of face-to-face instruction. BL calls for simultaneous implementation of various method of delivery to get the most out of methods and reach the assigned goals (AlKhaleel, 2019).

Mishra and Koehler (2006) confirmed the vital role of technology in education and introduced the TPACK framework; other researchers agreed about the TPACK framework (e.g., Knight & Elliott, 2009; Shin et al., 2009) and stated that TPACK helps teachers, by technology integration, to have a more successful teaching and learning process.

Scholars (Koh et al., 2010) agreed about the effectiveness of TPACK, which provides teachers with strategies to use appropriate technology in line with learning content. As the technology used in the educational setting is necessary, all teachers are required to acquire technological knowledge and use it in their classrooms. As Mishra and Koehler (2006) declared, with TPACK, teachers could re-evaluate learning goals and make their learners think outside the box.

Bagheri (2020) tried to develop and validate a self-report questionnaire, which is applicable to probe technological pedagogical content knowledge (TPACK) perceptions of Iranian EFL teachers. He generated a survey instrument containing items adapted from two existing TPACK-based questionnaires. The content validity and reliability were checked. He proposed a seven-Likert scale comprising 31 items questionnaire. He maintained that the constructed questionnaire was reliable and valid for determining the perceived level of technology integration literacy of Iranian EFL teachers.

Scholars (Lindsay, 2004; Scardamalia, Bereiter, 1994) confirmed that BL could be considered a beneficial instructional model since it can be designed in a way that could encourage students to actively engage in the learning process. Student involvement in the blended course design increases their reflections.

Cooner (2010) claimed that BL could improve students' learning experience by developing their ability for reflection. He examined learners' experiences in developing their reflective ability by using a technology-enhanced blended learning design. The results indicated having access to communications equipment, online lectures, a workbook, and online video case studies could motivate learners to have reflection on action.

Sendag and Odabasi (2009) run research by using a BL model for about 11 weeks; they tried to investigate how the online learning approach influenced students' critical thinking skills. They found that learning in the online group influenced the development of critical thinking ability.

As Yuan et al., (2008), and Wannapiroon (2008) compared the critical thinking mean scores of learners who participated in a BL instruction; They found a significant improvement in their post-test. They suggested that studying for a longer period might provide useful information about critical thinking skills. Lane (2016) found that the implementation of the BL model could increase students' critical thinking skills.

While many researchers have investigated BL, there remains a gap in our understanding of how this knowledge is associated and expects the teacher's reflection and critical thinking. For this aim, the present research was conducted to answer the following research questions.

RQ1*: Does blended-learning training instruction based on TPACK have any significant impact on Iranian EFL teachers' reflection?*

RQ2*: Does blended-learning training instruction based on TPACK have any significant impact on Iranian EFL teachers' critical thinking?*

METHODOLOGY

Design

This quantitative research study was a quasi-experimental design wherein a pretest-posttest design was employed. Quantitative research design is a systematic examination of phenomena by gathering quantifiable data and conducting statistical or computational techniques. On the other hand, quasi-experimental research is not true experimental; the participants are not randomly selected because a random assignment is difficult or impossible. (Cook & Campbell, 1979).

The groups were 'Experiment Group' in which the participants have been trained where BL setting has been provided and 'Control Group' in which the participants have been trained where the traditional learning environment is presented.

The variables of this research are BL as an independent variable and teachers' reflection and teachers' critical thinking as dependent variables.

Participants

The participants of the current study were 60 Iranian EFL teachers, who were chosen based on convenience random sampling from among 100 EFL teachers from Shahid Rajaee Teacher Training Center in Tehran, Iran.

They were 30 male and 30 female teachers and their ages ranged from 27 to 35 years old. As to eliminate the possible effect of their teaching experience on the results, the researchers have selected EFL teachers with up to 5 years of teaching experience. Furthermore, to assure the same level of language proficiency, an Oxford Placement Test (OPT) was administered to 100 EFL teachers, and those with ±1 SD from mean were selected as the participants.

Table 1

Demographic Background of the Participants

Number of Teachers	60 (30 in EG & 30 in CG)
Gender	Females & Males
Mother Language	Persian
University Major	TEFL
Institute	Shahid Rajaee, Tehran
Academic Years	2019-2021

Instruments

Oxford Placement Test (OPT)

An 'Oxford Placement Test' (OPT) was used to ascertain the participants' homogeneity. OPT was designed by Allan (1992); it consists of 60 questions in four sections namely, vocabulary, grammar, reading, and cloze test. OPT is a standardized test from Oxford University Press

that can identify the proficiency level of the students; its reliability and validity have already been confirmed. Based on the test results 60 EFL teachers were selected whose proficiency level was upper intermediate.

Reflection Questionnaire

Reflective Thinking Questionnaire (RTQ) by Kember et al., (2000). It is 16 seven-point Likert Scale items from "definitely agree" to "definitely disagree". According to Ghanizadeh and Jahedizadeh (2017) validating the Persian version of the RTQ, the reliability and validity were confirmed.

Critical Thinking Questionnaire

The Critical Thinking Dispositions Questionnaire (CTDQ), developed by Ricketts (2003), was used to measure the teachers' critical thinking disposition. The CTQD questionnaire contained 33 five-point Likert scale items. Asadpour and Mohammadi (2019) evaluated the Persian version of CTDQ.

TPACK Questionnaire

TPACK questionnaire was derived from Koehler and Mishra (2005). The original questionnaire contained 14 items with the reliability of .89. Bagheri (2020) and Baser et al., (2016) made some amendments to it. The final TPACK-EFL survey included 39 items. It is a nine-point rating scale; the lowest one was nothing or none, which was graded as 1 and the highest one was great deal, graded 9.

Procedures

A number of 100 EFL teachers were selected from Shahid Rajaee Teacher Training Center in Tehran, Iran, among them 60 EFL teachers were selected based on their scores on OPT test. Their scores were within one standard deviation below and above the mean.

They were assigned randomly to an experimental group and a control group; each group included 30 participants.

In the first and last sessions of the treatment, all participants were asked to answer the three, above-mentioned questionnaires, which were considered as their pre-test and post-test scores. During the 12 sessions of intervention, the control group went through traditional face-to-face instruction, while the experimental group conducted a BL instruction based on TPACK model. It should be added that the content and the period of instruction was the same for both groups.

Intervention

This research adopted a flexible BL model, which featured an online platform that delivers most of the curricula. BL instruction was 12 sessions, an online class, for 90 minutes each session.

The blended-learning retraining instruction based on TPACK was applied to examine its effect on Iranian EFL teachers' reflection and critical thinking from the second session of the course. The conducted BL was based on the principles of Bailey's (1996) model.

Through the intervention, the researcher observed the classes to ensure that Bailey's (1996) principles were strictly followed. The instructor attempted to engage all teachers. Some clips and websites were also introduced for the teachers to share their ideas on the targeted principle. The teachers were also supposed to provide a clip from their classrooms and bring it to the classes to be discussed. Additionally, after creating an account under their real names, the teachers were assembled in an online group developed by the instructor. All the teachers were required to go online at a pre-arranged time. To this end, before the instruction, all of the teachers were informed of the exact time and date of the study. BL instruction lasted twelve sessions, about two months during which two principals covered every session and the introduction of these finished in the seventh session. The other remaining four sessions were dedicated to criticizing the teachers' products, commenting on the extent, to which the principles were visible in their products, critical analysis of the rationales behind including or excluding the discussed principles, and brushing up on the products. Finally, the teachers retook the questionnaires in the twelfth session.

Data Analysis

To answer the questions both descriptive statistics and inferential statistics were used. For

descriptive statistics, N, mean, SD, standard error of mean was used. Besides, for inferential statistics, some paired and independent sample t-tests were run.

Three independent sample t-tests were run on the pre-test mean scores of all three questionnaires of both groups in order to make sure that there was no significant difference at the outset of the study with regard to the variables under study. Furthermore, three paired sample t-tests were conducted to compare the pre-test mean scores of each group in pre-and post-test to find whether there was any significant difference due to conducting the treatment. At last, the post-test mean scores of experimental and control groups were compared by means of independent sample t-tests.

RESULTS

Reliability of the Instruments

Before utilizing the research instruments, their reliability indices were assessed by a pilot study. Fifteen EFL learners who shared similar characteristics with the main participants in the study were randomly selected and piloted.

Table 2

Reliability Indices of the Research Instruments

Instrument	Items	Index
OPT	100	.86
TPACK Questionnaire	50	.79
Critical Thinking Questionnaire	33	.85
Reflection Questionnaire	16	.74

Table 2 presents the number of items and the reliability of the research instruments. According to the above table, the highest reliability is .86 related to OPT with 100 items, and Reflection Questionnaire with 16 items has the lowest reliability, which is equal to .74. Besides, the reliability of CTQ and TPACK Questionnaire are .86 and .79, respectively.

Descriptive Analysis

The descriptive statistics of the experimental and control groups were analyzed and reported in Table 3.

Table 3

Descriptive Statistics of the Control and Experimental Groups

groups	Questionnaire	test	N	Mean	Std. Deviation	Std. Error Mean
control	TPACK	Pre-test	30	3.53	1.65	.30
		Post-test	30	4.06	1.52	.27
	Critical Thinking	Pre-test	30	2.77	1.05	.19
		Post-test	30	2.88	1.06	.19
	Reflection	Pre-test	30	2.82	.94	.17
		Post-test	30	3.02	1.04	.18
experimental	TPACK	Pre-test	30	3.46	1.33	.24
		Post-test	30	6.7	1.41	.25
	Critical Thinking	Pre-test	30	2.85	1.03	.18
		Post-test	30	4.2	.92	.16
	Reflection	Pre-test	30	2.85	1.04	.19
		Post-test	30	3.97	1.31	.24

Table 3 indicates that the TPACK mean score of control group was 3.53 in pre-test, which increased to 4.06 in post-test. On the hand, TPACK mean score of experiment group was 3.46 in pre-test, while increased to 6.7 in post-test.

The control group's mean score of critical thinking were 2.77 and 2.88 in pre-and post-test, respectively. Besides, the experiment group's mean score of critical thinking were 2.85 and 4.2 in pre-and post-test.

The pre and post-test mean score of reflection in control group were 2.82 and 3.02 while that of experiment group was 2.85 in pre-test and 3.97 in post-test.

Comparing groups' pre-test

Three independent sample t-tests were run on the comprising groups' pre-test mean score to check whether they were the same at the outset of the study. The related data is reported in Table 4.

Table 4
Independent Sample T-test of Pre-tests

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Reflection	Equal Variances assumed	.421	.519	-.116	58	.908	-.03	.257	-.54	.48
Critical thinking	Equal Variances assumed	.019	.890	-.284	58	.778	-.07	.270	-.61	.46
TPACK	Equal variances assumed	1.77	.188	.172	58	.864	.06	.387	-.70	.84

Table 4 reveals that there were no statistically significant differences between the two groups' pre-test mean scores (Refection: sig=.908; Critical thinking: sig- .778, TPACK: sig= .864)

Experiment Group's Mean Score Analysis

For exploring the performance of the experiment group, three paired sample t-tests were run. Table 5 is dedicated to revealing the results.

Table 5
Paired Samples Test of Experiment Group

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Reflection	-1.11	.83	.152	-1.42	-.80	-7.31	29	.000
Critical thinking	-1.35	1.04	.191	-1.74	-.95	-7.06	29	.000
TPACK	-3.23	2.14	.391	-4.03	-2.43	-8.25	29	.000

According to the above table, there was a significant difference between the pre-tests and post-tests mean scores of all three variables (Refection: sig=.000; Critical thinking: sig- .000, TPACK: sig= .000).

Comparing Control and Experimental Groups' Performance

In order to reveal the impact of intervention, three independent sample t-tests were run on the post-tests mean scores of both groups, which are reported in Table 6.

Table 6
Independent Samples Test of Post-tests

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Reflection	1.542	.219	-3.09	58	.003	-.946	.30629	-1.55	-.333
Critical thinking	.038	.847	-5.11	58	.000	-1.316	.25767	-1.83	-.800
TPACK	.123	.727	-6.91	58	.000	-2.633	.38081	-3.39	-1.871

Table 6 compares the post-tests of the control and experiment groups in order to check the effect of the intervention. According to the obtained results, there was a significant difference between the post-test mean score in all three variables (Refection: sig=.003; Critical thinking: sig- .000, TPACK: sig= .000).

DISCUSSION

The present research revolved around testing the effect of BL based on TPACK on EFL teacher's critical thinking and reflection. To this aim, the research was conducted by two research questions.

The first research question asked if blended-learning training instruction based on TPACK has any significant impact on Iranian EFL teachers' reflection. Based on the data analysis blended-learning training instruction based on TPACK increased EFL teachers' reflection.

The findings are in line with Farrell and Lim's (2005) study. They suggested that TPACK has an impact on teachers' practices. Cooner (2010) also reach the same finding; he found that BL develops the learners' reflection.

Besides, the results lend support to research in which the positive effect of BL on the increase of reflection was supported (e.g., Lindsay, 2004; Scardamalia, Bereiter, 1994).

The second research question probe into the effect of blended-learning training instruction based on the TPACK effect on Iranian EFL teachers' critical thinking. As the results signify the blended-learning training developed teachers' critical thinking.

The results are supported by Khanalizadeh and Allami's (2012) findings. They declared that TPACK could improve thinking skills. Drajati et al., (2018) found the same results; they found that TPACK influences the pedagogical practices and approaches adopted by ESL teachers.

The finding was supported by other studies finding such as Lane (2016), Sendag and Odabasi (2009), Yuan et al., (2008), and Wannapiroon's (2008) findings who found the positive effect of the BL model on increasing critical thinking.

CONCLUSION

The present study examined whether blended-learning retraining instruction based on TPACK had any significant influence on Iranian EFL teachers' reflection and critical thinking. The results revealed that blended-learning retraining instruction based on TPACK had a significantly positive effect on Iranian EFL teachers' reflection and critical thinking.

The current research can have both pedagogical and theoretical implications in the English language teaching field. Pedagogically speaking, the research has direct implications for EFL teacher educators, school administrators, and other stakeholders to be encouraged to develop TPACK-based professional programs for EFL teachers.

This research was conducted with 60 male and female Iranian EFL teachers from Shahid Rajaee Teacher Training Center in Tehran. The research might be replicated with more participants to examine the interplay between teachers' TPACK, reflection, and critical thinking. Furthermore, the current research has not considered the participants' gender differences, probing into the effect of gender in the next studies could add to the depth of findings. In contrast, all participants of the current study were at the same level; selecting participants with different language proficiency might shed more light on the issue. Moreover, teachers' and students' personality traits, proficiency levels, gender, motivation, age, and cognition need to be researched because they will likely influence how the students learn a language. Including other data sources from students and policy-makers would enable a greater variety of perspectives.

It was assumed much more participants were needed to be involved in such studies to generalize the findings easily. Besides, due to time and budget restrictions, the researcher was not able to choose the participants from various EFL contexts such as universities and different cities.

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