Effects of Problem-Based Instruction on EFL Students' Critical Thinking Skills

*Endalamaw Abatyihun Sema [1], Simachew Gashaye Yesigat [1], Belachew Zerihun Dememe [1]

[1]Department of English Language and Literature, College of Social Sciences and Humanities, Debre Markos University, PO Box 269, Debre Markos, Ethiopia

Abstract

This study aimed to investigate how problem-based instruction affected the critical thinking skills of EFL students. 33 second-year students in the Political Sciences and International Relations department at Debre Markos University participated in the study during the 2022–2023 academic year. A quasi-experimental design, namely an interrupted time series design, was used on a single group of participants based on a pragmatic viewpoint. Through the use of both quantitative and qualitative methodologies, a mixed-methods approach was put into practice. The purposive sample approach was used to choose these 33 students who took the Basic Writing Skills course. Tests and student journals were used to collect data. Three argumentative essay writing pretests were administered to the participants before and after the intervention. An intra-Class correlation coefficient was utilized to assess the Critical Thinking Skills Rubrics (CTSR) instrument's inter-rater reliability. After verifying the five assumptions of the Repeated Measures ANOVA, the quantitative data were examined using descriptive statistics, within-subject effects, the grand mean, and pairwise comparisons. As a result, the study's results showed that problem-based instruction exceeded students' critical thinking abilities. As a result, problem-based instruction is recommended as a way to help students develop their critical thinking skills because this method helps them develop the core critical thinking skills for essay writing—interpretation, analysis, evaluation, inference, explanation, and self-control. In addition, thematic analysis was used to assess the qualitative data from the students' reflective journals. The results showed that, despite some negative reflections, the student's reflections on the problem-based instruction practices in the writing classroom were significantly favorable. Qualitative research revealed that PBI enhanced students' capacity for critical thought. PBL is recommended as an alternative teaching approach that might be used to help students develop their critical thinking skills in the ELT writing classroom.

Keywords: Problem-based instruction, Critical thinking skills, Argumentative essay, Writing instruction, English as a foreign language

1. Introduction

English has been recognized as a significant language due to its growing role as the world's lingua franca and as a tool for instruction and research, both internationally and in Ethiopia. Despite this, Ethiopian students at all levels of education struggle to acquire and use it for everyday activities and are falling behind (MOE, 2005). For undergraduates, the challenges are greater, particularly in written communication. There are many impeding factors in this problem. According to writing pedagogy researchers Alamirew (2005), Dawit (2013; 2014), Meseret (2012), and Mesfin (2013), poor writing instruction, methodological beliefs, and a mismatch

between the theory of teaching writing skills and the actual classroom implementations These, in turn, impede the teaching practices and the practicality of the student's critical thinking skills in the writing classroom in particular. Hence, a new era in language education known as the "post-method period" has emerged in recent years as a result of trends in language teaching and learning that have experienced significant and rapid changes in the 21st century: dissatisfaction with other ELT approaches, the demand for generic skills, particularly critical thinking skills, and a paradigm shift from the positivist to a constructivist perspective (Kumaravadivelu, 2006). Accordingly, there is a pressing need to employ an instructional approach that enhances students' writing performance. One of the more prominent tools of this new focus on learning is Problem-Based Learning (PBL).

Problem-Based Learning (PBL) is also called Problem-Based Instruction (PBI). It was originally introduced by its proponents, Barrows and Tamblyn (1980s), at the medical schools at McMaster University in Canada in the hope that it would increase self-directed learning and improve their problem-solving skills. Since then, PBI has moved into mainstream education in most content areas in KG–12 and, more reluctantly, into higher education as well (Savin-Baden, 2000). Though PBI has successfully moved from the medical field into other fields of study, one final frontier for instruction is using problem-based learning in ELT pedagogy due to the dearth of studies on PBI in language teaching (Hayati, 2005). Larsson (2001), the pioneer of the approach in ELT pedagogy, discussed the role of PBI tutorship in the teaching and learning of languages. Following this, further studies were conducted on the effect of PBL on language learning (Azman and Shin, 2012), and the consensus was that PBI could be one of the most groundbreaking approaches in education in the 21st century and necessary in the current era of globalization to assist students in developing critical thinking skills in the ELT pedagogy.

As it has been noted by Burkhalter and Nancy (2016), critical thinking skills are also essential for success in writing and social situations since they involve judging, reasoning, problem-solving, and decision-making. They claim critical thinking ability broadly comprises skills and dispositions. Critical thinking skills (CTSs) are concerned with cognitive skills such as interpretation, analysis, evaluation, explanation, inference, and self-regulation, which all enable individuals to make judgments about given ill-structured problems, while critical thinking dispositions (CTDs) relate to the affective domain, including inquisitiveness, systematicity, analyticity, truth-seeking, open-mindedness, self-confidence, and maturity. Developing students' critical thinking skills has been a crucial component of the language teaching curriculum, as it fosters students' abilities to interpret, analyze, evaluate, explain, infer, and self-regulate information, as well as to make their own decisions related to their academic success (Nold, 2017). Thus, the researcher focused on CTSs as they could be objectively measured and their cultivation is a principle of university education.

Within PBI, students work in small groups to interpret, analyze, evaluate, explain, infer, and self-regulate a controversy, list the possible solutions to the problem scenarios, and propose the best solution by explaining the reasons to back up their arguments in an essay (Leong, 2009). Hence, PBI builds students' critical thinking skills since they work collaboratively in exploring the issue, finding alternative solutions, building awareness of the consequences of each alternative solution, and proposing the most viable solution. Besides, PBI improved students' critical thinking skills as it helped them develop interpreting, analyzing, evaluating, inferring, explaining, and self-regulating skills, which are the core critical thinking skills while writing (Facione, 2015). Students will be engaged in writing lessons and tasks that enhance their ability to apply these aspects of critical thinking skills because the approach emphasizes producing texts through core critical thinking skills.

More specifically, studies conducted at different times have demonstrated different findings on the effects of PBI on students' critical thinking skills. For instance, Yibo (2012) studied the effects of PBI on the CTDs of Thai secondary school students, and the findings revealed that PBI significantly improved students'

CTDs at the secondary school level. Kumar and Refaei (2017) demonstrated the power of PBI to promote students' CTSs in a second-year research writing course, and it revealed that PBI helped learners develop CTSs. Bashith and Amin (2016) also conducted a study on the effects of PBI on EFL students' critical thinking skills and learning outcomes, and the result showed that the PBI model affected students' CTSs.

However, studies on these specific domains have also produced discouraging results. Temel (2014) attempted to compare the effects of traditional teaching approaches versus PBI on pre-service teachers' critical thinking skills. The results showed that PBI and conventional approaches did not have different effects on the critical thinking of the pre-service teachers. PBI had no impact on the student's critical thinking skills in Burris's (2005) study, which looked at the effect of PBI on critical thinking skills in secondary schools. Besides, Anazifa and Djukri's (2017) investigation found that PBL had no different effects on students' critical thinking skills when studying ESL. In a nutshell, there is theoretical support for employing PBI to foster students' critical thinking skills. However, researchers suggest that there is limited empirical research on such a theoretical basis.

Today's ELT research trends have mostly shifted away from emphasizing language and linguistics to encouraging students to take on social responsibility in the context of the global community. However, there has been a strong urge towards the development and implementation of soft skills, sometimes known as 21st-century learning and teaching approaches or critical thinking skills. Even though the majority of studies found that PBI improved students' critical thinking skills, some other researchers are dubious about its effectiveness. The majority of them showed encouraging findings, and examining the literature on the implementation of PBI in EFL learning revealed that it could be said that it had either positive, negative, or neutral effects. Based on these inconsistencies, examining how the approach affects students'' critical thinking skills in ELT writing pedagogy was quite necessary.

2. Statement of the Problem

To cope with the current global challenges and demands of workplaces, students need not only a bulk of knowledge but also effective written communication competency and other learning skills such as critical thinking. Language teachers still struggle with the issue of how to improve and encourage language learners' writing abilities, especially in the context of ESL/EFL, which leads to critical thinking skills for undergraduate university students. Numerous elements that contribute to students' challenges have been found through studies. For instance, the traditional teaching approaches, according to Abdullah (2014) and Hyland (2003), do not encourage the promotion of thought among students. As a result of the recent development and pedagogical paradigm shifts from positivism to constructivism, the implementation of these writing techniques also needs to move forward to be compatible with the modern EFL writing pedagogy and 21st-century learning skills, critical thinking skills in particular (Badger & White, 2000). A study conducted by Chaleila and Garra-Alloush (2019) also interestingly noted that critical thinking skills had not been widely explored in the context of EFL learners' writing instruction. Evidence has shown much more effort has been put into teaching writing skills, but as Nejmaoui (2018) mentioned, EFL learners still suffer from difficulties in critical thinking skills in their writing classroom. In this regard, it seemed that the problem referred to the teaching approach the teachers use in the writing classroom. In light of the difficulties, finding an efficient approach that facilitates learning and helps enhance students' critical thinking skills in the writing pedagogy seems quite necessary. One of the learning approaches in line with this orientation is Problem-Based Instruction (PBI). PBI is, therefore, determined to be the intercessor approach to alleviating the students' problems with critical thinking skills in the ELT pedagogy. In EFL writing pedagogy, enhancing students' critical thinking skills play a prominent role in activating their prior knowledge of the theme they should write about and enabling them to develop and grow their imaginations (Dharma, 2014). By having imagination, they could

explore and then convey their ideas in good essay writing. From this elaboration, it could be inferred that the critical thinking skills used in PBI could facilitate the student's generation of high-quality writing performance. PBI activities might be crucial in promoting critical thinking skills, and they may shed some light on minimizing such problems.

As a result, based on the researcher's preliminary classroom observation, critical thinking skills have been presented by most of the teachers just after the introduction of the course content by critically analyzing and solving related problems and then asking students to solve similar problems. The tasks used in essay writing were as simple as creating some sentences by using the given topic to write about and then working individually to compose a piece of writing without having any challenging parts that stimulated them to think critically and put their creative ideas into writing. Hence, the students were unable to produce a wide-ranging essay. It was also revealed that the teacher seemed to place less concern on using critical thinking skills to help students develop their writing skills. Enhancing the critical thinking skills of ELT graduates by allowing them to employ cognitive skills and understand argumentative problem scenarios that may help them improve their generic skills (critical thinking skills) in particular during essay writing. The proponents of PBI also believe that the investigation and resolution of real-world problems will motivate student engagement. They find that the students engaged in PBI will establish a critical thinking pattern, develop creative thinking skills, and learn independent leadership skills, (Barrows &Tamblyn, 1980).

In a nutshell, the ELT writing instruction, the syllabus, overview of the contents, writing activities, and course materials, do not promote students' critical thinking skills; they are highly fancy with the surface learning (like lecturing and memorization), the teaching approach the teachers follow, and the students' lack of linguistic competency, and these were also evident in the writing classroom, in the Basic Writing Skill course, where students are usually given a topic to write about and then work individually to compose a piece of writing. The assistance mainly came from the teacher, who read the draft and gave written feedback. The situation demanded that some new pedagogy like PBI be experimented with to see whether it might be effective in improving students' critical thinking skills.

In the Ethiopian Higher Education ESL curriculum, various types of academic writing should be learned by the students, including expository, narrative, descriptive, and argumentative writing, to prepare them to meet the writing demands of academic institutions. Hence, based on some levels of writing, the most appropriate level to foster critical thinking skills is argumentative essay writing, and from my classroom realities, the argumentative writing genre is the most complicated skill to master graduates. Because of the prevalence of argumentative writing in the academic curriculum and the challenges associated with its development, a common component of ESL writing classrooms consists of helping learners develop argumentative writing skills compared with other writing discourses. Unlike others, political science students who deal with different cases, scenarios, principles of lawsuits, programs, democracy, international policy, political issues, contesting solutions, etc., are especially supposed to think critically and give appropriate and justifiable reasons for their arguments. To do so, they need to find suitable teaching approaches to enhance their critical thinking skills. Once students develop their experiences in this way, their critical thinking skills might be enhanced.

Putting it back to the context of ELT in Ethiopia, however, to the best of the researcher's knowledge, hardly any studies have explored the effects of PBI on students' critical thinking skills as EFL learners in Ethiopian universities. Reasonably, Solomon (2018) researched PBL with critical thinking dispositions and writing self-efficacy among department of law students at UOG, and the findings showed that there were significant differences between the groups in critical thinking dispositions and writing self-efficacy. Likewise, Bantalem (2020) focused on the effects of using inquiry-based learning on EFL students' critical thinking and argumentative writing skills, and the findings of the study revealed that using inquiry-based argumentative

writing instruction enhances students' critical thinking skills. In response to the changes in learning due to the demands of 21st-century skills, the Ethiopian government developed the EEDR (2018–2030), aiming at changing the old structure of the curriculum (knowledge-based) to an alternative one and outreaching a competence-based (skill-based) type of curriculum, which stresses producing lifelong learners, accompanied by appropriate teaching methods of the current paradigms. To meet such demand, acknowledging PBI, which is pedagogically sound, scholarly beneficial, and socially desirable for educational reform, has been claimed to allow students to develop critical thinking skills in the teaching of writing skills in the EFL, which might be crucial. And the lack of empirical research on PBI in Ethiopian ELT and the apparent hesitancy to implement it in the domain of English, especially in improving their critical thinking skills, is also another rationale for this study. To bring the discussion to a close, although the local studies were conducted on writing skills in different contexts with different aims, neither of them could treat the effects of PBI on students' critical thinking skills. It seems scarcely available in the Ethiopian context.
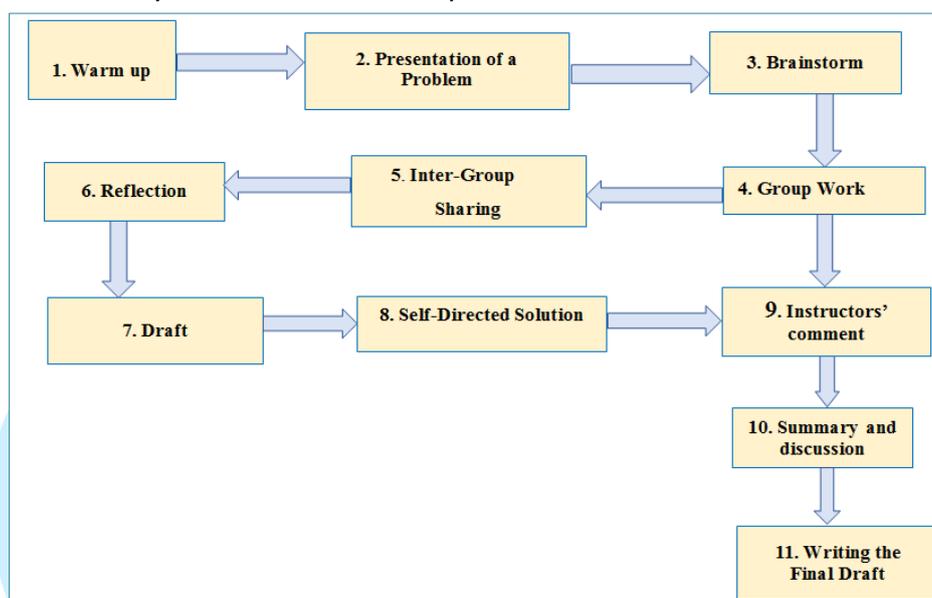

Fig. 1 Problem-Based Instruction (*Adapted from*: Yibo, 2012)

3. Research Questions

The study endeavored to answer the following research questions:

1. What effect does problem-based instruction have on students' critical thinking skills?
2. What are the students' reflections regarding the practices of problem-based instruction?

4. Objectives of the Study

The objective of the study was to investigate the effects of problem-based instruction on students' critical thinking skills. This study was also intended to explore students' reflections regarding the practices of problem-based instruction.

5. Research Design and Methods

The study's experimental design took a quasi-experiment with multiple time series designs in which the dependent variables were measured at multiple time points before and after the presentation of the intervention. The researcher held a pragmatic position, which is suitable for this study because pragmatism embraces mixed methods as the third research community.

6. Participants Setting and Sampling Techniques of the Study

The participants of the study were 33 second-year students in the Department of Political Sciences and International Relations at Debre Markos University in 2022–2023. In this study, the researcher employed

purposive sampling methods, which is a non-random sampling technique to determine the single group participants. As a result, non-randomized assignments of samples were used. Besides, the researcher gave training to the trainee instructors. Though one EFL teacher was enough to deliver the intervention-based instruction, one reserve teacher was also trained to substitute for him in case there was any inconvenience and to fill out the treatment fidelity checklist.

7. Data Collection Instruments

7.1 Tests

To assess the students' existing critical thinking skills, three consecutive argumentative framed prompt pre-tests requiring argumentative essay writing were provided before the intervention. Similar to pretests, after the intervention, three consecutive argumentative framed prompts problem scenarios requiring them to write argumentative essays were administered to determine the effect of the intervention and assess whether students' critical thinking skills had improved. In other words, immediately after the intervention, posttest 1 was given, and another intervention was used. Then, right away after receiving instruction, posttest 2 was given, and a week later, following the withdrawal of the intervention, a delayed posttest 3 was given. The argumentative problem scenarios used in the pretests and posttests had nearly equal difficulty levels as they were validated by experienced Language Specialists, Ph.D. Candidates, Supervisors, Educational Measurement and Evaluation Professionals, and Political Sciences and IR Professionals before they were used in data collection. The scenarios were developed and modified by the researcher by considering different variables pertinent to the problem scenario preparations, including the writing situation (contextual variables), the subject matter (content variables), the wording of both the prompt and the instructions (linguistic variables), the tasks (task variables), the rhetorical specification (rhetorical variables), and the scoring criteria (evaluation variables).

7.2 Critical Thinking Skills Rubrics

To measure the students' critical thinking skills in their argumentative essay writing problem scenarios, analytic critical thinking skills rubrics were used. The instructor assigned points or weights to particular criteria and then evaluated students' performance in each area. The six critical thinking skills used in the critical thinking skills rubrics were—analysis, evaluation, interpretation, inference, explanation, and self-regulation. In doing so, the critical thinking skills scoring rubrics were adapted from the rubric of Facione, (2015). The scoring system used a four-point scale, with (1) low, (2) average, (3) high, and (4) very high, respectively.

7.3 Students Reflective Journals

The reflective journal was employed to collect data on the overall practices of Problem-Based Instruction on students' critical thinking skills. The reflective journal was with 9 major reflective questions. Accordingly, the participants reported their feelings on the practices of Problem-Based Instruction. Finally, in analyzing students' reflective journals, a pseudonym was used instead of their real names.

8. Data Collection Procedure

8.1 The Pre-Intervention Phase

The students were made aware of the study's objectives before the study. Due to the researcher's desire to monitor the successful implementation of the training, the facilitators received extensive training and were required to attend weekly sessions [1 hour and 30 minutes daily for a total of 7 hours of training over 5 days]. The training was designed based on the following points: to begin with, the core training areas were devoted to building the conceptual framework of the PBI approach. In this sense, raising awareness of the importance

of PBI was critical in ensuring that the facilitators had a thorough understanding of the concept and instructional technique. In addition, the training was grounded in the phases of instruction. Finally, the students were given three argumentative essay writing pretests (pre-intervention problem scenarios) and examined their writing performance before they were assigned to the intervention.

8.2 During The Intervention phase

During this phase, the facilitator provided training to the participants about the Problem-based instruction steps in the writing classroom and how they practice each PBI step in their argumentative essay writing problem scenarios. Then, the facilitator provided the participants with three argumentative ill-structured problem scenarios and the students started providing argumentations, and solutions through implementing the PBI steps, namely: **(1) warmup (whole activity)** the facilitator assigned his and the participants' roles. Group members acted as the chair, timekeeper, and scribe when necessary. Then the facilitator introduced the problem-based instruction to the students before dividing them into groups to motivate and get students ready for the instruction followed by a few questions related to it and it is also designed as a pre-teaching stage for the instruction. **(2) Present the problem (whole activity)**, the facilitator started the lesson using the instruction by introducing the argumentative problem scenarios to the class through conceptual mappings, graphic organizers, images, and words, and the students discovered and identified the known and unknown points of the issue like the essences of the argumentative problem scenarios, the different controversies of the issue, the suggested solutions. **(3) Brainstorming (whole activity)** Students responded to questions about their previous personal experiences pertinent to the argumentative problem scenarios by eliciting their opinions, arguments, and solutions for the argumentative problem scenario given. **(4) Working in groups (group activity),** grouping students and providing resources, worksheets, and sharing each other's opinions, arguments, and solutions about the argumentative problem scenarios. The scribe of the group wrote down each group's points of discussion, arguments, and solutions. **(5) Inter-group sharing (whole activity)**. After the students first discussed and prepared inside groups, the teacher could re-build the group so that students can mix with other groups, or each group could send a representative to share their group arguments, and solutions. Each group member also wrote down the other group's solution, the logic behind as well as the main argumentation from other groups. **(6) Students' reflections (individual activity)** by reflecting in action that the extent to which they write argumentative essays used in the drafting stage. Let each scribe of the group reflect on their group discussions and intergroup sharing discussions in front of the class. The students combined their group argumentations, and solutions with their own and were ready for their upcoming first drafting process, the foregoing activities, and thinking about the preceding steps. **(7) Self-directed solutions (individual activity),** at this step, the facilitator gave each student the opportunity to begin organizing the arguments, and solutions raised and discussed during the above (1-6) problem-based instruction steps separately. **(8) Drafting (individual activity),** the facilitator showed them how to start writing the argumentative essay, and the overall structure of a five-paragraph argumentative essay. Here, the students themselves could identify the two thesis statements of the argumentative problem scenarios through written prompts given and start drafting the essay. Then peer feedback was also given to each other concerning their first draft. Revised and refined their writing after their work was given feedback by other groups. **(9) Instructor's comment (instructor's activity)** by observing students' argumentative essays, recorded observations, and after peer feedback, the facilitator also gave feedback according to the writing performance rubrics given during the teacher training stage. **(10) Class summary and conclusion (whole class activity)** by letting them discuss the drafting that leads them to the final draft with the active involvement of the students themselves during the process. **(11) Writing the final draft (individual activity)** the students begin to write their final essay writing based on their first draft and the instructor's comments, summary, and discussion.

The participants took part in different teaching sessions (2 hours and 30 minutes) each and were employed once a week for a total of about six training sessions. To exclude variables like the amount of time spent on the task at home and help from others, each implementation phase was used in class without disturbing the regular program.

8.3 The Post-intervention Phase

The three posttests were administered in the way aforementioned. After they were introduced to the particular genre, of argumentative essay writing genre in particular in the PBI classroom, students wrote three argumentative essays by themselves during the post-implementation phase. The data collected through tests and reflective journals were analyzed concurrently using a convergent design strategy during the post-intervention phase of the study. At this phase, analysis of the post-intervention data was carried out to see the changes that the PBI intervention had resulted in.

9. Validity and Reliability of the Instruments

The framed prompts were given to EFL Language Specialists, Ph.D. Candidates, Supervisors, Educational Measurement and Evaluation Professionals, and Political Sciences and International Relations Professionals before their use in data collection to check their appropriateness. They were also asked to review the written prompt problem scenarios and fill out a validation form. Before running any analysis, an inter-rater reliability analysis was conducted to determine the level of consistency between the scores of the raters using the intra-class correlation coefficient (ICC). From the analysis, a highly significant agreement of Critical Thinking Rubrics was found between the sores of the two raters (F=.765, p= 0.77, 95% Confidence Interval. The average measure ICC was .774. This means that there is 77% of agreement between the two raters. The ICC of the instruments indicated strong agreements between the raters. In other words, the two raters' ratings were highly consistent. Based on the 95% confidence interval of the ICC estimate, values between 0.75 and 0.9 and above are considered acceptable reliability (Koo & Li, 2016).

10. Data Analysis

The data analysis involved descriptive and inferential statistics. Quantitative and qualitative data were employed to measure the effects of PBI on students' critical thinking skills. The inferential data were analyzed with one-way repeated measures of ANOVA, using the Statistical Package for Social Sciences (SPSS) version 20 while the qualitative data were analyzed through thematic analysis. To establish inter-rater reliability, Two EFL instructors were selected randomly and as the result of this randomization, Two-Way Random Effects Model was chosen to run the inter rater-Intraclass-Correlation Coefficient (ICC) reliability and to determine the level of consistency between the scores of the raters. The convergent design strategy involves collecting quantitative and qualitative data concurrently in one phase (parallel to the quantitative data) and analyzing the two data sets separately.

11. Ethical Concerns of the Research

The following ethics approvals for participants were taken into account: participants' voluntariness, privacy, data confidentiality, anonymity, and future usage are respected throughout the research process. Before the formal data collection, a signed Consent Form (CF) and Participant Information Sheet (PIS) was sent to the Political Sciences and International Relations department and the College of Social Sciences and Humanities, Research, Community Service, and Postgraduate Studies coordinating offices to request permission. The offices were informed about the details of the study. Additionally, participants' confidentiality, anonymity,

privacy, and ability to use a pseudonym during the study were all assured. Consent forms were available in English.

12. Results and Discussion

12.1 Data Analyses and Findings of Students' CTSs scores before and after the Intervention

To address the first research question, the effects of problem-based instruction on students' critical thinking skills, the analyses and findings of students' critical thinking skills scores before and after the intervention were computed using Repeated Measures of ANOVA. To compare the pretests and posttests of a single subject group concerning the effects of PBI, both descriptive statistics and Repeated Measures of ANOVA tests results of the Within-Subject Effects (the core output), the Grand Mean, and Pairwise Comparisons of Repeated Measures of ANOVA are presented in the different tables below:

Table 1 Repeated Measures of ANOVA: Students' Critical Thinking Skills (CTSs) Test Scores before and after the Intervention (N=33)

Tests	Mean	Std. Deviation	N
Pre-test1	8.6465	.95448	33
Pre-test2	9.0253	.92339	33
Pre-test3	8.8232	1.06795	33
Post-test1	15.1162	.84006	33
Post-test2	15.1061	.76809	33
Post-test3	15.0657	.70457	33

Table 2 Repeated Measures of ANOVA: Tests Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
TIME	Sphericity Assumed	1944.876	5	388.975	519.721	0.00	.942	2598.606	1.000
	Greenhouse-Geisser		4.247	457.920				2207.358	1.000
	Huynh-Feldt		4.978	390.683				2587.247	1.000
	Lower-bound		1.000	1944.876				519.721	1.000
Error (TIME)	Sphericity Assumed	119.749	160	.748					
	Greenhouse-Geisser		135.910	.881					
	Huynh-Feldt		159.301	.752					
	Lower-bound		32.000	3.742					

a. Computed using alpha = .05

Table 3 Repeated Measures of ANOVA: The Grand Mean: Students' Critical Thinking Skills (CTSs) Scores (All Pretests and All Posttests)

Dependent Variable	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
All Pretests	8.832	.096	8.637	9.027
All Posttests	15.096	.090	14.913	15.279

Table 4 Repeated Measures of ANOVA: Pairwise Comparisons

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference [b]	
					Lower Bound	Upper Bound
Pretest1	Pretest2	-.379	.246	1.000	-1.159	.402
	Pretest3	-.177	.265	1.000	-1.016	.662
	Posttest1	*-6.470*	.225	.000	-7.184	-5.755
	Posttest2	*-6.460*	.204	.000	-7.106	-5.813
	Posttest3	*-6.419*	.216	.000	-7.105	-5.733
Pretest2	Pretest1	.379	.246	1.000	-.402	1.159
	Pretest3	.202	.226	1.000	-.514	.918
	Posttest1	*-6.091*	.212	.000	-6.764	-5.418
	Posttest2	*-6.081*	.221	.000	-6.782	-5.380
	Posttest3	*-6.040*	.207	.000	-6.696	-5.385
Pretest3	Pretest 1	.177	.265	1.000	-.662	1.016
	Pretest 2	-.202	.226	1.000	-.918	.514
	Posttest1	*-6.293*	.220	.000	-6.990	-5.596
	Posttest2	*-6.283*	.220	.000	-6.982	-5.584
	Posttest3	*-6.242*	.190	.000	-6.845	-5.640
Posttest1	Pretest1	*6.470*	.225	.000	5.755	7.184
	Pretest2	*6.091*	.212	.000	5.418	6.764
	Pretest3	*6.293*	.220	.000	5.596	6.990
	Posttest2	.010	.144	1.000	-.445	.466
	Posttest3	.051	.182	1.000	-.526	.627
Posttest2	Pretest1	*6.460*	.204	.000	5.813	7.106
	Pretest2	*6.081*	.221	.000	5.380	6.782
	Pretest3	*6.283*	.220	.000	5.584	6.982
	Posttest1	-.010	.144	1.000	-.466	.445
	Posttest3	.040	.191	1.000	-.567	.647
Posttes3	Pretest1	*6.419*	.216	.000	5.733	7.105
	Pretest2	*6.040*	.207	.000	5.385	6.696
	Pretest3	*6.242*	.190	.000	5.640	6.845
	Posttest1	-.051	.182	1.000	-.627	.526
	Posttest2	-.040	.191	1.000	-.647	.567

Based on estimated marginal means
*. The mean difference is significant at the .05 level
b. Adjustment for multiple comparisons: Bonferroni

The descriptive statistics table was interpreted within the context of the means and standard deviations. As a result, the mean and standard deviation of the student's critical thinking skills tests results before the intervention was (pre-test-1, M = 8.6465, SD = .95448; pre-test-2, M = 9.0252, SD = .92339, and pre-test-3, M = 8.8232, SD = 1.06795) which showed that the results have no significant differences. Likewise, the mean and standard deviation of the student's critical thinking skills post-test scores were (post-test-1, M = 15.1162, SD = .84006; post-test -2, M = 15.1061, SD = .76809, and post-test-3, M = 15.0657, SD = .70457) which indicated that the results have no significant differences. This means that the students' mean scores in the pre-tests were almost similar despite some differences. Similarly, similar mean scores were in the post-test results although some differences. However, when the mean scores in the pre-tests and post-tests were compared, they had significant differences. In other words, the students' mean scores in the post-tests were higher than those in the pre-tests. As has been observed in the table above that the lowest mean score was for pre-test1, pretest2, and pretest3 (before the intervention) and the highest at posttest1, posttest2, and posttest3 (after the intervention was completed). This implies that the student's critical thinking skills have been improved after the intervention, problem-based instruction, in the writing classroom.

The actual results of the repeated measures ANOVA are presented in the Tests of Within-Subjects Effects table. Tests of Within-Subjects Effects compare if there were any significant differences between means at any time point of the aspects of critical thinking skills scores (interpretation, analysis, inference, explanation, evaluation, and self-regulation) in the six conditions of three pretests and three posttests. Since the data seem spherical and were not violated, so I ignored the Greenhouse-Geisser, Huynh-Feldt, and lower bound results in the tests of the Within-Subjects Effects table above. Hence, the important rows in the Tests of Within-Subjects Effects table are the Sphericity Assumed rows i.e.; the difference between the means is statistically significant: F (5:160) =519.721, P<.05, ηp2=.942, observed power = 1.000). Accordingly, the Tests of Within-Subjects Effects result showed that there was a significant effect of problem-based instruction on students' critical thinking skills among the observations of the outcome or within-subjects. Needless to say, there is a statistically significant mean difference in the scores of the different aspects of the critical thinking skills (interpretation, analysis, inference, explanation, evaluation, and self-regulation) over the different time point outcomes. As a significant main effect is found, then pairwise comparison should be used to establish within-subjects differences variable (time).

The Grand Mean of the students' scores of critical thinking skills before and after the intervention depicted that the critical thinking skills mean scores in all the pretest and all post-tests were different and their Standard Errors of the two (all pretests and all posttests) were larger than that of their actual mean scores. Accordingly, the Grand Mean and Standard Error of students' critical thinking skills results of all pretests were (M = 8.832; Std. Error = .096), and all posttests (M = 15.096; Std. Error = .090). Hence, the students outperformed better in their posttest of the aspects of critical thinking skills (interpretation, analysis, inference, explanation, evaluation, and self-regulation) compared to their all pretests results of the aspects of critical thinking skills (interpretation, analysis, inference, explanation, evaluation, and self-regulation). This is to conclude that the intervention, problem-based instruction, plays a significant role in their scores improving the overall aspects of critical thinking skills.

As a significant main effect is found in the Tests of Within-Subjects Effects table, then the pairwise comparison of Bonferroni's adjustment for multiple comparisons was used. The Pairwise Comparisons table above provides the information on which group or set of scores the pretests and posttests, which compares every possible combination pairs of time points (conditions) and indicates whether the difference between them is significant (Sig. column). From pairwise comparisons table above, the p-values for the following comparisons: Pretest1 vs. pretest2 | p-value =1.000, pretest1 vs. pretest3 | p-value = 1.000, pretest2 vs. pretest1 | p-value = 1.000, pretest 2 vs. pretest3 | p-value = 1.000, pretest3 vs. pretest1 | p-value = 1.000, pretest3 vs. pretest2 | p-value = 1.000, posttest1 vsposttest2| p-value = 1.000, posttest 1 vs posttest3| p-value =1.000, posttest2 vs posttest1| p-value = 1.000, posttest2 vs posttest3| p-value = 1.000, posttest3 vs posttest1| p-value = 1.000, and posttest3 vs posttest2| p-value = 1.000 are the p-values were above (p> .05). It showed that these comparisons were insignificant while all the other comparisons had p-values below (p<.05) and their Mean Differences column which shows that there were significant differences. This is to mean that even though there were test score differences among the student's critical thinking skills pretests and post-tests, the improvement was not high compared to the test score differences made between the student's critical thinking skills pre-tests and the post-test scores. Likewise, these differences were made due to the intervention given to the students.

Hence, the intervention, problem-based instruction, improved the students' aspects of critical thinking skills (interpretation, analysis, inference, explanation, evaluation, and self-regulation). In concluding the issue, the implementation of problem-based instruction during argumentative essay writing improved the students' critical thinking skills and abilities. This result is in line with a research finding conducted by (Bashith & Amin, 2017) which shows that the implementation of problem-based instruction in EFL writing classrooms increased

the students' critical thinking skills, the cognitive aspects (interpretation, analysis, inference, explanation, evaluation, and self-regulation) in particular.

12.2 The Reflective Journal

The data gained from the students' reflective journals was grouped into two thematic areas and thus analyzed thematically: Positive and Negative Reflections about PBI implementations. Each theme was analyzed as follows:

12.2.1 Students' Positive Reflections on the Practices of Problem-Based Instruction

Students stated that Problem-Based Instruction improved their social skills, critical thinking skills, language skills, and academic skills. Some of their reflections on these skills were as follows:

Excerpt 1: (1307880)

While we were engaging with the implementation of problem-based instruction steps to better argument and suggest solutions, our argumentation and decision-making skills were highly improved. They also stated that they were confused at the beginning but later they realized that the scenarios require multiple solutions and this triggered them to generate different solutions. It also increases their creativity and they are also becoming autonomous and responsible for their learning, mention the importance of this awareness of their future academic career and real-life situations **[argumentation, problem-solving skills, creating different solutions]**

Excerpt 2: (1308057)

When we were performing PBI activities, the activities require knowledge of different vocabularies, so as we encountered different problem scenarios, we are also exposed to different vocabularies that help to implement each problem-based activity. Hence our vocabulary has become richer. This was reflected in our daily PBI lessons. **[vocabulary].**

Excerpt 3: (1306385)

During the implementation of PBI steps in the writing classroom, we are expected to write different argumentative problem scenarios. These helped us to improve our writing abilities as politics is full of arguments. So it helped us in our future writing projects, assignments, and senior essays with the different types of sentences with the correct sentence structures. **[writing Skills, building sentences]**

Considering the positive opinions about PBL in general, it can be asserted that students develop themselves in terms of social skills, academic skills, critical thinking skills, and language learning skills. In the findings, the skills that all students meet on a common ground are linked to critical thinking skills. This conclusion coincides with the quantitative findings. Qualitative findings point out that PBL is effective in improving students' critical thinking skills in their argumentative essay writing.

12.2.1 Students' Negative Reflections on the Practices of Problem-Based Instruction

Excerpt 1: (1305846)

In their negative reflection on the problem-based instruction theme, they stated that they had faced difficulties in reconciling with the group members during the PBI implementation steps. Some group members acted as free riders and they did not do their part while the majority in the group tried to do their part. This gets a little annoying. **[Group dispute]**

Excerpt 2: (1308049)

One of the biggest challenges that we faced during our problem-based instruction practices was communication problems with friends. We came from different parts of the country whose mother tongue is

different and most of us were not good in the Lingua Franca, the Amharic language, and difficult to express ourselves even in Amharic, which is the lingua Franca of the Ethiopians. This made us tired and lost much time and it was a hard time in this situation. **[Difficulty communicating in English]**

Excerpt 3: (1308136)

There were group members from Sudan, whose culture was different from Ethiopians. Even we Ethiopians have different cultures with different languages. Students who come from open cultures are easy to integrate with the rest of the members and others who were from the closed culture or conservative families, they are socially introverted and shy in the group, and working with these students as a group and trying to implement problem-based instruction steps is not easy as their culture is different, our opinions also could not coincide. **[Different perceptions of culture]**
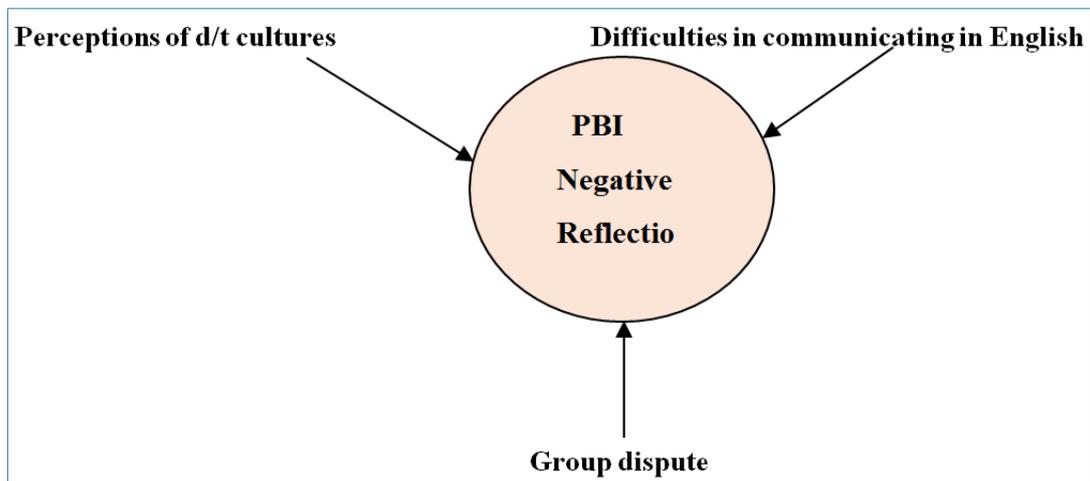
By and large, the finding revealed that problem-based instruction enhances students' aspects of critical thinking skills (interpretation, analysis, explanation, inference, evaluation, and self-regulation). As has been shown in the above quantitative table results, the students' CTSs post-test results showed steady improvement compared with the pretest results. In line, the students' reflective journal data also showed that their perceptions of the implementation of PBI in the writing classroom outweighed positively despite challenges that were perceived during the implementation of the PBI steps. This significant improvement was due to the model the researcher adapted and implemented, the selection of the ill-structured problem scenarios as they are characterized as leading to learning issues, controversial, trigger interest, framed prompt format, real life, promote teamwork, provide multiple perspectives, ill-structured and it has advantages, improves the ability to think critically.

Empirically, the effect of the PBL model on critical thinking skills is reinforced by Masek and Yamin's (2011) research, which states that the specific processes in PBL theoretically support students' critical thinking development according to the design applied. Although the researcher could not find research findings conducted locally or abroad with exactly similar research topics, (i.e. the effect of problem-based instruction on students' critical thinking skills), the results of this study are congruent with earlier research, like, Bashith and Amin (2017) the effect of problem-based learning on EFL students' critical thinking skill and learning outcome. Based on the analysis of data from the research findings, the critical thinking skills of the experiment group are higher than the control group and the model is significant to improve the student learning outcomes.

Based on the findings, it is recommended for EFL teachers and learners, however, this does not mean that using PBI should replace all other methods in EFL writing instruction; rather it should be used in addition to those methods to boost development further. Furthermore, EFL teachers need to understand how to design and implement the PBI lessons in a way that can promote better critical thinking skills and enhance learners' opportunities of being reasonable, critical thinkers, and accommodate themselves to the demand of the 21st pedagogical paradigm shifts in general and critical thinking skills in particular.
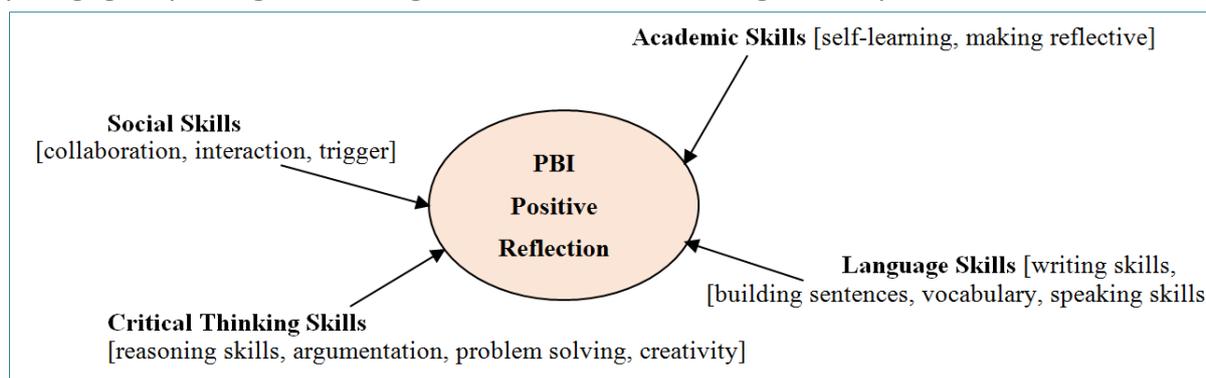
Fig. 2 Students' Positive Reflections on the Practices of Problem-Based Instruction

Fig. 3 Students' Negative Reflections on the practices of Problem-Based Instruction

13. Conclusion and Implication

The findings of the study revealed that the use of PBI in EFL writing instruction empowers students' critical thinking skills. PBI has positive impacts on student's critical thinking skills which include interpretation, analysis, inference, evaluation, explanation, and self-regulation. In other terms, when the students have used PBI steps (warm-up, presentation of problems, brainstorming, group discussions, inter-group sharing, self-directed solutions, writing tasks, reflections, instructor's comments, summary, and discussion, and revision) to write an argumentative essay in their academic writing classes, they have comprehended thesis statement and topic sentences, generate ideas related to the topic sentences in their essay writing (interpretation); examining ideas by identifying main claims and supported reasons, identified and examined arguments, reasons, and claims (analysis); identified elements of claims, estimated alternatives, and draw reasonable conclusions in writing their argumentative essays (inference). Similarly, they also assess claims and arguments by recognizing the factors affecting the credibility, relevance, and acceptability of information or opinion in the argumentative issues made in their conclusions (evaluation); stating results, justifying procedures, presenting arguments giving reasons for agreeing to claims, or to argue and express objections on a claim (explanation), and consciously monitored and corrected their writing activity (self-regulation) in producing argumentative essays. Thus, the students have developed their critical thinking skills through the implementation of PBI in the writing pedagogy.

Therefore, this study aims to contribute to the general understanding of PBI and the use of critical thinking skills in writing instruction. The findings provided more empirical evidence on the effectiveness of the PBL approach in developing students' critical thinking skills. The results of the study might also assist various stakeholders in the education system, like teachers, students, educational leaders, curriculum designers, and policymakers, to recommend and provide a good environment for the implementation of the PBL approach to learning in universities, as well as provide the necessary materials and resources. PBI is suggested as a means to improve EFL students' critical thinking skills because the approach incorporates ill-structured, complex, open-ended, authentic, and related to the student's real-life situations. This is to imply the need to promote PBI which is based on a problem-solving approach that mostly involves students in analyzing, interpreting, explaining, inferencing, evaluating, and self-regulating the information given. Accordingly, EFL teachers should use PBI in their writing classrooms to develop students' critical thinking skills. Similarly, teaching material developers need to consider the salient features of Problem-Based Instruction in developing the teaching materials to use in the writing classroom, so that students improve their critical thinking skills. Students should also use the problem-based instruction steps to produce effective argumentative texts, be critical thinkers, and become lifelong learners.

Finally, the study had some limitations. Firstly, most of the studies carried out so far about PBL are in the realm of principles such as medicine and business and there is no satisfactory plethora of research in language education; hence, the studies on PBL and language learning are scant and discussing the results in light of previous research was to some extent cumbersome. This fact, to a great extent, limited the literature of the study and the research as well. Secondly, the intervention was given for 21 hours for 9 weeks to second-year Political Sciences and International Relations department students, at Debre Markos University. Hence, the time given to the intervention was relatively small. However, it does not mean that the intervention was completely inadequate since the students practiced the whole instruction process repeatedly. It is to mean that the findings of the study would have been more convincing if more time for the intervention had been used.

Abbreviations

EFL: English as a Foreign Language
ANOVA: Analysis of Variance
SPSS: Statistical Package for Social Sciences
PBI: Problem Based Instruction, CTS: Critical Thinking Skills

Availability of data and materials

Please contact corresponding author for data requests.

Authors' contributions

The corresponding author and the supervisors of the research had their own contributions in the process of conception and design, shaping the instruments, acquisition of data, and analysis and interpretation of data. All of them take significant responsibility for the whole content.

Declaration of Conflict

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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