

The Effectiveness of Jigsaw Method as a Socio-Cognitive Stimulus in Translation Training for Pre-Service Teachers: A Quasi- Experimental Study

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Abstract

This study, employing a quasi-experimental pretest-posttest design with one group, investigates the socio-cognitive impact of the jigsaw method on teaching translation principles to Iranian pre-service teachers. The study addresses two main gaps in translation education: the lack of collaborative learning and the neglect of student-teachers' role as educational change agents. The statistical population consisted of 100 student-teachers from Farhangian University in Kerman province, who were purposefully selected. Initially, to control for language proficiency, the Oxford Placement Test (60-item version) was administered, confirming the homogeneity of participants' English language levels. A pretest on translation was then conducted, followed by the implementation of the jigsaw method over 16 sessions of 90 minutes each, based on Aaronson's (1978) standard protocol. At the end, a posttest on translation and a researcher-made questionnaire (19 items with Likert scale) were administered to assess students' perception of the method's effectiveness. The validity of the questionnaire was confirmed by five experts, and its reliability was verified with a Cronbach's alpha coefficient of 0.839. Data were analyzed using one-sample t-tests, paired samples t-tests, Pearson correlation, and one-way ANOVA. Quantitative findings showed that the mean posttest scores were significantly higher than the pretest scores, with a large effect size indicating a significant practical impact of the jigsaw method on improving translation accuracy, fluency, and cultural transfer. The questionnaire results also revealed that students had a positive and significant perception of the method's effectiveness. Positive and significant relationships were observed between socio-cognitive learning and improvement in translation skills, active learning and improvement in translation, and group interactions and socio-cognitive learning. This study suggests that the jigsaw method can be included as an effective educational strategy in the curriculum of translator-teacher training in Iran.

1. Introduction

Foreign language education and the training of competent translators constitute fundamental pillars of contemporary education. The translation process is inherently bidirectional, requiring multilingual proficiency, cultural awareness, and cognitive flexibility. Consequently, translation principles instruction necessitates innovative approaches that foster deep learning, constructive interaction, and self-regulation among students. One such effective approach is the Jigsaw method, first introduced by Aronson (1978) as an interactive strategy for group learning. This method enhances learning from passive reception to participatory and analytical experience by dividing content into small sections and creating interdependence among members. While the effectiveness of Jigsaw has been established across various educational domains, its application in translation education, particularly among Iranian student-teachers, remains underexplored. In Iran's educational system, particularly at Farhangian University, reliance on traditional lecture-based methods has resulted in the neglect of social and cognitive dimensions of translation learning, such as collective problem-solving, peer feedback, and shared knowledge construction. Consequently, many graduates, despite possessing theoretical knowledge, demonstrate weaknesses in practical translation skills, teamwork, and critical thinking. Accordingly, the present study investigates the impact of the Jigsaw method on developing translation skills and social-cognitive interactions among Iranian student-teachers, while also identifying the challenges and requirements for localizing this method within Iran's educational context. More recent research by Wang et al. (2023) and Liu et al. (2024) further emphasizes that collaborative and technology-enhanced approaches can improve learners' motivation, self-efficacy, and analytical thinking, underscoring the urgent need to revise traditional translation teaching methods.

Translation education, particularly in the domain of teacher training, plays a pivotal role in nurturing future language teachers and translators. However, many existing curricula still rely on traditional, transmission-oriented approaches that confine learning to passive information reception and neglect the cultivation of deep cognitive and social skills. In such circumstances, innovative approaches like the Jigsaw method can provide a foundation for transformation in translation education. By emphasizing collaboration, dialogue, and group accountability, this method teaches student-teachers how to simultaneously enhance their linguistic skills, critical thinking, and intercultural competence in an interactive and creative environment. Consequently, Jigsaw is not merely an educational tool but also a model for reconstructing pedagogical mindsets and reinforcing the professional identity of future teachers.

The primary objectives of this research are: 1) assessing the extent of this method's impact on improving practical translation skills in terms of accuracy, fluency, and cultural transfer; 2) examining the role of Jigsaw in strengthening group interactions, critical dialogue, and peer feedback; 3) analyzing its effect on developing cognitive skills such as critical thinking, collective problem-solving, and self-regulated learning; and 4) identifying implementation and contextual challenges, particularly within Iran's cultural-educational context. Following the theoretical framework and literature review, this article proceeds to methodology, findings, discussion, and conclusion.

2. Theoretical Framework and Literature Review

2.1. Theoretical Framework

This research is grounded in Bandura's (1986) social-cognitive learning theory, which conceptualizes the learning process as the product of dynamic interaction among three factors: behavior, environment, and cognition. According to this theory, individuals learn not only through direct experience but also through observing others' behavior, modeling, and self-regulation, which play decisive roles in skill development. Within the framework of translation education, particularly in the Jigsaw method, student-teachers initiate learning by observing how their peers solve problems in source text analysis, then engage in cognitive restructuring of their knowledge through oral explanation of translation strategies in expert groups, and finally internalize professional standards through collective evaluation of translations. This process of "observational learning" is what Bandura terms "proxy agency"—learning through participation in group experiences and observing others' skills.

The structural framework of this social-cognitive approach is grounded in Johnson and Johnson's (2009) principles of cooperative learning. These theorists identify five key components of cooperative learning: positive interdependence, individual accountability, promotive interaction, social skills, and group processing. In the Jigsaw method, each of these components is realized in specific ways within the translation education context. Dividing the subject into specialized sections creates interdependence among members; expert groups reinforce individual accountability; peer teaching fosters promotive interaction; and the consensus-building process in reconstructing the target text cultivates conflict resolution skills. As Slavin (1995) emphasizes, this structure transforms translation from an individual activity into a collective and distributed process in which group efficacy surpasses the sum of individual abilities.

According to Bonwell and Eison's (1991) active learning framework, mastery of translation skills requires procedural knowledge that can only be achieved through participation, experience, and practical practice. Within

this framework, student-teachers engage in processes leading to deep and lasting knowledge formation by analyzing specialized sections of texts, conveying concepts to others, and collectively revising translations. This process, in addition to learning theoretical concepts, results in enhanced self-regulation, critical thinking, and cognitive reflection.

Vygotsky's (1978) principle of internalization posits that learning begins in the context of social interaction and gradually transforms into individual ability. In the process of learning translation through the Jigsaw method, when student-teachers defend their stylistic choices or equivalences in group discussions, they enter a level of epistemological thinking—"cognition about cognition"—examining and rethinking the knowledge bases and reasons behind their translation decisions. As Tsai (2020) emphasizes, such dialogues not only strengthen reasoning and professional judgment in translation but also elevate the learning process from knowledge reproduction to analysis and cognitive creation.

From the sociolinguistic perspectives of Wardhaugh (2010) and Evans and Green (2006), social variables play a significant role in Jigsaw's effectiveness. Shared academic and linguistic identity among student-teachers (such as shared language or similar pre-service teaching status) reduces linguistic and psychological barriers and facilitates the alignment of cognitive schemas. Wardhaugh explains this phenomenon through metaphorical schemas: the container schema is activated when knowledge is perceived as a shared resource among members. The path schema manifests in the circulation of knowledge through specialized roles and peer teaching. The force schema emerges in the process of resolving interpretive conflicts and collective decision-making.

Such group homogeneity, according to Wardhaugh (2006), provides the context for linguistic and intellectual convergence among members and leads to the formation of shared understanding of translation concepts.

Ultimately, the integration of cognitive linguistics perspectives (Evans & Green, 2006) with sociolinguistics (Wardhaugh, 2010) offers a predictive model for the transformation of educational attitudes. In this model, shared academic background among members activates the object schema and facilitates concept transmission in peer education; continuous professional interaction strengthens the link schema and increases collective responsibility; and successful group experience leads to the formation of the attraction schema, which consolidates positive attitudes toward collaboration among student-teachers. Consequently, the Jigsaw method functions as a social-cognitive tool in which Bandura's proxy agency, Johnson's positive interdependence, Wardhaugh's social variables, and Bonwell's active processing converge to transform translation skills from an individual activity into a collaborative, self-regulated, and critical process. This synergy ultimately cultivates dual awareness in student-teachers—the ability to simultaneously attend to linguistic accuracy and cultural intent, which Pym (2023) identifies as a fundamental characteristic of professional translators.

2.2. Literature Review

This section introduces studies relevant to the research topic. These studies share similarities and differences with various aspects of the present research, including the theoretical framework, analytical section, and discussion. Following the introduction of these studies and the presentation of results and discussion in the research, their connections, overlaps, and differences will be analyzed and examined in relation to the theoretical framework.

Johnson and colleagues' (2000) systematic review of eight cooperative learning models demonstrated that these methods have positive and significant effects on academic achievement. Their analysis confirms that cooperative learning, as an evidence-based instructional strategy with robust theoretical foundations, not only effectively enhances academic performance but also simultaneously reinforces secondary outcomes such as increased motivation and improved social skills.

Ning and Hornby (2010), employing a quasi-experimental pretest-posttest control group design, examined the effectiveness of cooperative learning in English language teaching at Chinese universities. Their findings indicated that listening, speaking, and reading skills improved significantly in experimental groups, but no statistically significant differences were observed in writing skills and vocabulary expansion. These results suggest that the efficacy of cooperative methods manifests differently across various language skill domains.

In the field of translation education, Yuliasri (2014) conducted an experimental study to investigate the effect of the Jigsaw method on Indonesian-English translation students. Results showed that the experimental group demonstrated higher accuracy and fluency in translation compared to the control group, while also exhibiting greater social skills, motivation, class participation, and text comprehension. These findings confirm the dual effectiveness of the Jigsaw method in simultaneously enhancing cognitive and social dimensions of learning.

Mellinger (2019) investigated the cultivation of metacognitive skills, including planning, monitoring, and evaluation, in professional translation education. Using reflective writing and qualitative content analysis of two specialized tasks, he demonstrated that purposeful curricula incorporating continuous feedback, self-assessment, and structured reflection not only improve translation quality but also enhance the metacognitive awareness essential for self-directed professional performance.

Tsai's (2020) comparative analysis of traditional and collaborative methods in translation education revealed that group translation with technological support, whether face-to-face or virtual, significantly improves learners' productivity, cognitive engagement, and learning outcomes. These findings indicate that collaborative approaches are pedagogically superior and more effective alternatives to traditional lecture-based methods in translation education.

In Arabic-Indonesian translation courses, Fitriyah and Fauzi (2020) documented the effectiveness of the Jigsaw method in enhancing translation quality in terms of accuracy, meaning transfer, and textual coherence. Their research also reported increased student motivation for text analysis and expanded lexical diversity in group translations, directly linking Jigsaw implementation to improved social-cognitive outcomes.

El Bahri and Darir (2023), from a social-cognitive perspective, demonstrated significant cognitive benefits resulting from structured translation practice. Their findings indicated that regular translation activities strengthen critical thinking abilities, particularly analytical reasoning, evaluative judgment, and inferential skills. This research provides robust empirical evidence of the positive relationship between translation activities and cognitive skill enhancement.

Wang et al. (2023) found that structured implementation of the Jigsaw method significantly increases learners' self-efficacy. Their findings also showed that this method creates simultaneous improvements in academic motivation (goal-oriented effort in learning) and academic hardiness (resilience in facing challenges), thus confirming the psycho-social benefits of this approach.

Choi (2024) evaluated a team-teaching model in English-Korean translation education in which instruction was delivered simultaneously by a Korean instructor and a native English-speaking instructor. This co-teaching approach, which leveraged complementary linguistic expertise, proved particularly effective in non-native English educational contexts. Empirical results demonstrated that this method enhanced educational quality, increased student acceptance, and improved class participation.

Recent research on technology-enhanced collaborative methods, including Liu et al.'s (2024) study, indicates that these approaches have positive and significant effects on foreign language learning. In addition to improving core language skills (reading, writing, listening, and speaking), these methods strengthen critical thinking, communication abilities, metalinguistic awareness, motivation, and reflection in the learning process. Furthermore, the effectiveness of these approaches depends on factors such as learning group composition, learner learning styles, activity design, and program duration.

Despite this rich body of literature, notable research gaps exist. On one hand, the aforementioned studies were conducted in non-Iranian educational contexts, and the applicability of their findings to the structures and challenges of Iran's teacher education system remains unclear. On the other hand, most existing research focuses solely on "translation learning" and pays less attention to the dual role of "student-teacher" as both a translation learner and a method modeler. Therefore, the present study aims to fill these two gaps by investigating the effectiveness and social-cognitive mechanisms of the Jigsaw method in translation education for Iranian student-teachers.

In line with the overall research objective, investigating the social-cognitive impact of the Jigsaw method in teaching translation principles to Iranian student-teachers, the following questions were formulated:

1. Is the mean score of student-teachers' perception of the overall impact of the Jigsaw method on improving translation skills (in terms of accuracy, fluency, and cultural transfer) significantly higher than the average level?
2. Is there a positive and significant relationship between the mean scores of student-teachers' social-cognitive learning (such as feedback, interaction, and self-monitoring) and the mean scores of translation skill improvement?
3. Is there a positive and significant relationship between the mean scores of active learning (role-playing, critical thinking, and self-directed learning) and the mean scores of translation skill improvement?
4. Is there a positive and significant relationship between the mean scores of group interactions and collaborations and the mean scores of student-teachers' social-cognitive learning?

3. Research Methodology

This research is quantitative in approach and quasi-experimental in nature, employing a one-group pretest-posttest design. This approach was selected due to the nature of the research problem, which focuses on measuring the impact of the Jigsaw method on quantitative variables. In this design, a pretest was first administered to assess participants' baseline translation skills, followed by the educational intervention (Jigsaw method) over 16 sessions, and finally a posttest was administered to measure the intervention's effect on the dependent variable. Required data were collected through a researcher-developed questionnaire and translation tests (pretest and posttest) and analyzed using descriptive and inferential statistical methods.

3.1. Participants

The statistical population comprised student-teachers majoring in English language teaching who were enrolled in the “Translation Principles and Techniques” course at Farhangian University of Kerman Province. The sample was purposively selected and included 100 participants (47 male and 53 female). Most participants were aged 20–25 years, and 88% had less than one year of teaching experience. The research was conducted with informed consent, and all participant information was kept confidential and used solely for academic purposes.

3.2. Research Instruments

Three main instruments were used for data collection: (1) the Oxford Placement Test to control for participants’ language proficiency, (2) two parallel texts for objective assessment of translation skills in pretest and posttest, and (3) a researcher-developed questionnaire to measure student-teachers’ perceptions of the Jigsaw method’s impact. These instruments are described in detail below.

3.2.1. Questionnaire for Assessing Student-Teachers’ Perceptions of Jigsaw Method Effectiveness

The data collection instrument was a researcher-developed questionnaire (Appendix 1), designed based on the research theoretical framework, comprising 19 items across six sections (demographic information, social-cognitive learning, cooperative learning, active learning, Jigsaw method effectiveness in improving translation skills, and group interactions). Responses were measured on a five-point Likert scale from “strongly disagree” to “strongly agree.” The construction, validation, and reliability establishment processes were conducted through sequential and rigorous procedures, described in detail below.

The foundation and framework for item design were Bandura’s (1986) social-cognitive learning theory, Johnson and Johnson’s (2009) cooperative learning principles, and Bonwell and Eison’s (1991) active learning model. Initially, a preliminary pool of 25 items was developed based on theoretical constructs and research objectives. This draft was submitted to five experts with published articles in educational psychology, translation education, and English language teaching. Experts were asked to evaluate each item in terms of relevance to the intended construct, clarity of expression, simplicity of understanding, and comprehensiveness of coverage on a three-point scale (essential, useful but not essential, not essential). Based on their feedback, the Content Validity Index (CVI) was calculated for each item and for the entire instrument. The Content Validity Ratio (CVR) was also employed. Items with CVR below 0.99 (for 5 judges) were removed or substantially revised. Ultimately, a questionnaire with 19 main items and 4 demographic items was obtained, with a total CVI of 0.94 and each item’s CVI above 0.80, indicating excellent content validity. The final structure of the questionnaire was established across six theoretical sections as follows:

1. *Demographic characteristics* (4 items): gender, age, field of study, teaching experience.
2. *Social-cognitive learning* (items 1–4): measuring constructs of observational learning, peer feedback, and cognitive modeling.

3. *Cooperative learning* (items 5–8): measuring resource sharing, collective deliberation, and group decision-making.
4. *Active learning* (items 9–12): measuring cognitive engagement, critical thinking, and active participation.
5. *Method effectiveness on translation skills* (items 13–16): measuring perceived improvement in accuracy, understanding of principles, and motivation.
6. *Group interactions and collaboration* (items 17–19): measuring interaction quality and help-seeking for improvement.

All items in sections 2 through 6 were scored on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

To examine the underlying structure and construct validity of the questionnaire, exploratory factor analysis (EFA) was conducted using maximum likelihood extraction with Promax rotation (due to expected factor correlations) on data from the 100 participants. Factor analysis prerequisites were thoroughly examined and confirmed:

1. Sampling adequacy: The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.872, which falls within the “excellent” range according to Kaiser’s (1974) classification.
2. Significance of correlations: Bartlett’s test of sphericity was significant ($\chi^2 = 1202.842$, $df = 171$, $p < 0.001$).

Using Cattell’s scree test (inflection points in the scree plot) and eigenvalues greater than 1, five significant factors were identified, collectively explaining 74.3% of the total data variance. The pattern of factor loadings after rotation presented a clear structure consistent with the theoretical foundations. All items had factor loadings above 0.55 on their respective factors and cross-loadings below 0.30 on other factors. This pattern confirms satisfactory construct validity and appropriate differentiation among questionnaire constructs.

Instrument reliability was confirmed through Cronbach’s alpha coefficient of 0.839, exceeding the 0.7 criterion. Thus, the questionnaire demonstrates satisfactory validity and reliability.

3.2.2. Translation Skills Assessment Instrument (Pretest and Posttest)

To objectively measure the impact of the Jigsaw method on improving student-teachers’ translation skills, a translation test was administered at two time points: pretest (first session) and posttest (final session) (Appendices 2 and 3). These tests comprised the translation of two English texts (approximately 250 words each) with similar difficulty levels and general topics (cultural and social), selected from *Select Readings: Upper-Intermediate* (Lee & Bernard, 2011) and appropriate for participants’ language proficiency. To ensure the parallel nature of the pretest and posttest texts, expert opinions from three experienced instructors of the *Translation Principles and Techniques* course were utilized.

To evaluate students’ translations, an “Analytic Scale for Translation Quality Assessment” was employed, designed and localized based on existing theoretical frameworks including House’s (2015) model and components highlighted in Yuliasri’s (2014) research. This scale measures three main components of translation quality (accuracy, fluency, and cultural transfer) on a 5-point Likert scale (1 = very poor to 5 = very good):

Accuracy component assessment criteria, measuring the extent of correct and complete transfer of source text meaning to the target text without omission or addition of meaning, include correct transmission of main concepts, absence of meaning distortion, and selection of appropriate lexical equivalents.

Fluency component assessment criteria, measuring the naturalness and comprehensibility of the translation in the target language and adherence to grammatical and stylistic structures, include observance of Persian grammatical structures, naturalness of expressions, and textual coherence and cohesion.

Cultural transfer component assessment criteria, measuring success in transferring cultural elements of the source text in a manner comprehensible to Persian readers, include identification of cultural elements, selection of appropriate strategies for cultural transfer (domestication, explanation, equivalence), and preservation of the original text's cultural-semantic load.

To enhance objectivity and scoring reliability, pretest and posttest translations of each participant were independently evaluated by two assessors (experienced translation course instructors). Assessors were blind to the temporal order of tests (pre or post) to minimize potential bias. The mean scores from the two assessors for each component were considered as the participant's final score. To measure inter-rater reliability, the Intraclass Correlation Coefficient (ICC) was calculated, yielding values above 0.85 for all three components, indicating satisfactory assessment reliability. Each participant's total translation skills score was calculated as the sum of scores on the three components (maximum 15).

3.4. Procedures

This research was conducted in the second semester of the 2023–2024 academic year over 16 sessions of 90 minutes each at Farhangian University of Kerman Province. Prior to the semester, coordination meetings were held with instructors of the “Translation Principles and Techniques” course, a step-by-step implementation guide for the Jigsaw method was provided to them, and educational content was divided and organized into 5 “puzzle pieces” appropriate for this method's structure. In the first session, research objectives were explained to students, emphasizing voluntary participation and information confidentiality. After obtaining written informed consent from 100 student-teachers, to control for the confounding variable of language proficiency and ensure participant homogeneity, the Oxford Placement Test (60-item version) was administered to student-teachers in the first session of the semester (after initial familiarization with research objectives and before beginning the main Jigsaw instruction). This test, designed and validated by Oxford University Press (Allan, 2004), revealed that all 100 participating student-teachers achieved B2 (upper-intermediate) language proficiency. The participants' mean score on this test was 48.6 (out of 60) with a standard deviation of 3.8, ranging from 42 to 56. This finding indicates complete homogeneity of the sample in terms of language ability and enhances the internal validity of the research, as potential differences in results from Jigsaw implementation cannot be attributed to differences in participants' language proficiency levels.

After confirming the homogeneity of participants' language proficiency, the translation pretest (including translation of a standard text) was administered in the second session to assess baseline translation skills. Students were then familiarized with the Jigsaw method procedures and divided into groups of 4–5 members (home groups). During the 13 intermediate sessions, the Jigsaw method was implemented according to Aronson's (1978) standard protocol: at the beginning of each session, the instructor divided the translation text

into separate sections (number of sections equal to the number of group members); then, each member of the home groups joined “expert groups” for in-depth study of their specialized section, where students collaboratively analyzed texts, discussed translation strategies, and identified appropriate equivalents, with researchers and the instructor serving as facilitators; after expert groups completed their work, members returned to their home groups, and each member was responsible for teaching their specialized topic to other group members using their notes and analyses. In this stage, knowledge exchange, questioning and answering, peer feedback, and critical discussions actively took place. At the end of each session, groups collaboratively produced the final translation using all specialized pieces presented by members and submitted their output to the instructor for feedback. In the final session, the translation posttest (with a text parallel to the pretest) was first administered to measure translation skill improvement, followed by the researcher-developed questionnaire comprising 19 items across six sections on a five-point Likert scale (whose validity and reliability had been confirmed as described in the previous section), distributed to all 100 participants. Before completion, it was emphasized that responses should be based on the 16-session experience with the Jigsaw method. It is noteworthy that this research was conducted with participants’ informed consent, and all participant information was anonymized through coding, with data analyzed solely in aggregate form for academic purposes.

4. Findings

Following data collection, descriptive statistics of variables were calculated as a first step (Tables 1, 2, and 3).

Table 1
Demographic Characteristics of Participants and Descriptive Statistics of Questionnaire Scores

Variable	Classification	Frequency (N)	Percentage
Gender	Male	47	47%
	Female	53	53%
	Total	100	100%
Age	Under 20	15	15%
	20–25 years	70	70%
	25–30 years	10	10%
	Over 30 years	5	5%
	Total	100	100%
Teaching Experience	Less than 1 year	88	88%
	1–3 years	10	10%
	More than 3 years	2	2%
	Total	100	100%

Table 2
Descriptive Statistics of Total Questionnaire and Subscale Scores (19 Items)

Variable / Subscale	Number of Items	Observed Score Range	Mean Score	Standard Deviation	Cronbach's Alpha
Social-Cognitive Learning (Items 1–4)	4	12–20	16.2	2.4	0.822
Cooperative Learning (Items 5–8)	4	11–20	15.8	2.3	0.831
Active Learning (Items 9–12)	4	10–20	15.6	2.5	0.841
Method Effectiveness on Translation Skills (Items 13–16)	4	13–20	16.6	2.1	0.806
Group Interactions and Collaboration (Items 17–19)	3	9–15	12.3	1.7	0.832
Total Questionnaire	19	65–90	76.2	10.8	0.839

Table 3
Descriptive Statistics of Pretest and Posttest Translation Skills Scores

Test	N	Min	Max	Range	Mean	SD	Variance	Skewness	Kurtosis
Pretest	100	4	12	8	8.24	1.86	3.46	-0.21	-0.45
Posttest	100	8	15	7	12.42	1.93	3.72	-0.32	-0.51

4.1. Research Question 1: Overall Perception of Jigsaw Method Effectiveness

To address the first research question (overall impact of the Jigsaw method on improving translation skills in terms of accuracy, fluency, and cultural transfer), the assumptions of normal distribution, homogeneity of variances, and variable independence were first examined. Results showed no evidence of violation of necessary assumptions. Two types of analysis were used to answer this question: (1) analysis of objective scores from pretest and posttest, and (2) analysis of perceptual scores from the questionnaire.

As observed in Table 3, students' mean pretest score was 8.24 (out of 15) and posttest score was 12.42. Results of the paired-samples t-test (Table 4) showed that this difference was statistically significant ($t(99) = 14.62, p < 0.001$). The very large effect size ($d = 1.46$) indicates the substantial practical impact of the Jigsaw method on improving students' translation skills. Examination of the three components revealed that the greatest improvement was in the accuracy component (53.7% increase) and the least improvement was in the cultural transfer component (47.6% increase).

In the questionnaire section (Table 4), students' mean perception of Jigsaw method effectiveness on translation skill improvement (items 13–16) was 16.60 (out of 20), with individual item means ranging from 3.76 to 4.16. One-sample t-tests showed these means were significantly higher than the average level (score 3) ($p < 0.001$). The highest mean was for item 16 (effectiveness of collective translation evaluation) with a mean of 4.16 and

effect size of 1.28. The low standard error range (0.069 to 0.092) also indicates high estimation precision. These results indicate widespread positive perception of the Jigsaw method’s effectiveness.

The positive and significant perception of student-teachers regarding the Jigsaw method’s impact on improving translation skills (items 13–16 means between 3.76 and 4.16, all above 3) indicates activation of social-cognitive schemas referenced in theories of Bandura (1986), Johnson and Johnson (2009), and Wardhaugh (2010). The high means, particularly for item 16 (effectiveness of collective evaluation with mean 4.16), demonstrate how proxy agency in Bandura’s model has transformed observation and learning from peers into internalized patterns, such that student-teachers have formed domain-specific schemas related to the translation process when analyzing terminological issues in expert groups (item 13 with mean 3.76).

Table 4
Results of Paired-Samples t-test Comparing Pretest, Posttest, and Questionnaire Scores

Component	Mean Difference	SD Difference	t	df	Significance	Improvement Percentage	Cohen's d Effect Size
Accuracy	1.44	0.68	15.21	99	0.001	53.7%	1.52
Fluency	1.43	0.72	14.87	99	0.003	50.9%	1.49
Cultural Transfer	1.31	0.70	13.56	99	0.006	47.6%	1.36
Total Score	4.18	1.89	14.62	99	0.001	50.7%	1.46

Questionnaire: Jigsaw Method Effectiveness (Items 13–16)

Questionnaire Item	Mean	SD	t-statistic	Sig.	Cohen's d
Item 13	3.76	0.85	8.94	0.001	0.89
Item 14	3.95	0.79	12.03	0.001	1.20
Item 15	3.87	0.83	10.48	0.001	1.05
Item 16	4.16	0.82	14.15	0.001	1.28
Mean Total	3.94	0.77	12.4	0.001	1.24

Results from the one-sample t-test effect sizes indicated that the Jigsaw method has very high effectiveness, with Cohen’s d values for all items being large or very large (from 0.948 to 1.382). These values, along with completely positive confidence intervals and statistical significance ($p < 0.001$), demonstrate that student-teachers’ perceptions of the Jigsaw method’s impact on translation skills significantly exceed the average level. The largest effect size was for item 16 ($d = 1.279$; mean = 4.16), indicating remarkable improvement in more complex skills such as cultural transfer and collective problem-solving.

4.2. Research Question 2: Relationship between Social-Cognitive Learning and Translation Improvement

To address the second research question regarding the relationship between social-cognitive learning and translation improvement, Pearson correlation coefficient was used (Table 5). Results showed a positive and

significant correlation between social-cognitive learning and posttest scores ($r = 0.56, p < 0.01$). This value indicates a relatively strong correlation between these two variables. A positive and significant correlation was also observed between social-cognitive learning and the amount of improvement (difference between posttest and pretest scores) ($r = 0.43, p < 0.01$). This finding suggests that students who scored higher on social-cognitive learning demonstrated greater improvement in translation skills.

Table 5
Pearson Correlation Matrix between Variables

Variable	Social-Cognitive Learning	Pretest	Posttest	Amount of Improvement
Social-Cognitive Learning	1			
Pretest	0.21*	1		
Posttest	0.56**	0.32**	1	
Amount of Improvement	0.43**	-0.15	0.71**	1
* Significant at 0.05 level; ** Significant at 0.01 level				

As shown in Table 6, the coefficient of determination ($R^2 = 18.5\%$) indicates that approximately 18.5% of the variance in translation skill improvement is explained by social-cognitive learning. A weak but significant correlation was observed between social-cognitive learning and pretest scores ($r = 0.21, p < 0.05$), which seems logical since the pretest was administered before Jigsaw implementation. Based on these findings, the positive and significant relationship between social-cognitive learning and translation skill improvement is confirmed. This result is consistent with Bandura’s (1986) and Johnson and Johnson’s (2009) theoretical frameworks and demonstrates that social interactions, peer feedback, and observational learning play important roles in improving students’ translation skills.

Table 6
Results of Simple Regression Analysis (Predicting Amount of Improvement Based on Social-Cognitive Learning)

Predictor Variable	Unstandardized Coefficient (β)	Standardized Coefficient (β)	t-statistic	Significance	R ²	R
Social-Cognitive Learning	0.34	0.43	4.72	0.001	0.185	0.43
Constant	-1.28	-	-1.84	0.068		

4.3. Research Question 3: Relationship between Active Learning and Translation Improvement

To examine the relationship between active learning and translation skill improvement, Pearson correlation coefficient and simple regression analysis were employed. Prior to conducting the tests, assumptions of data normality and linearity of the relationship (examined through scatter plots) were confirmed. Descriptive findings showed that the mean active learning score was 15.60 (out of 20) and the mean amount of translation skill improvement was 4.18 (out of 15). Pearson correlation results (Table 7) indicated a positive and significant relationship between active learning and posttest scores ($r = 0.48, p < 0.001$), as well as between active learning and the amount of translation skill improvement ($r = 0.36, p < 0.001$).

Table 7
Pearson Correlation Matrix between Active Learning and Translation Variables

Variable	Active Learning	Pretest	Posttest	Amount of Improvement
Active Learning	1			
Pretest	0.15	1		
Posttest	0.48**	0.32**	1	
Amount of Improvement	0.36**	-0.15	0.71**	1
** Significant at 0.01 level				

Simple regression analysis (Table 8) showed that active learning explains 13% of the variance in translation skill improvement ($R^2 = 0.130$, $R = 0.36$), and the standardized regression coefficient ($\beta = 0.36$) indicates a positive and significant effect of this variable on translation improvement. Regression analysis of variance also confirmed the significance of the model ($F(1,98) = 14.60$, $p < 0.001$).

Table 8
Results of Simple Regression Analysis (Predicting Amount of Improvement Based on Active Learning)

Predictor Variable	Unstandardized Coefficient (β)	Standardized Coefficient (β)	t-statistic	Significance	R^2	R
Active Learning	0.27	0.36	3.82	0.001	0.130	0.36
Constant	-2.35	-	-2.06	0.042		

Therefore, the research hypothesis regarding the existence of a positive and significant relationship between active learning and translation skill improvement is confirmed. This finding is consistent with Bonwell and Eison's (1991) active learning model and demonstrates that active role-playing, critical thinking, and self-directed learning within the Jigsaw method context play important roles in enhancing students' translation skills. Overall, active learning plays a significant role in strengthening translation skills, but the greatest effect is achieved when employed alongside social interactions and Bandura's proxy agency within a complete collaborative environment.

4.4. Research Question 4: Relationship between Group Interactions and Social-Cognitive Learning

To examine the relationship between group interactions and social-cognitive learning, Pearson correlation coefficient and simple regression analysis were employed. Prior to conducting the tests, assumptions of data normality and linearity of the relationship were confirmed. Descriptive findings showed that the mean group interactions score was 12.30 (out of 15) and the mean social-cognitive learning score was 16.20 (out of 20). Pearson correlation results (Table 9) indicated a positive, strong, and significant correlation between group interactions and social-cognitive learning ($r = 0.62$, $p < 0.001$). This is the highest correlation coefficient among all research variables. Positive and significant correlations were also observed between group interactions and posttest scores ($r = 0.58$) and the amount of translation skill improvement ($r = 0.42$).

Table 9
Pearson Correlation Matrix between Group Interactions and Social-Cognitive Learning

Variable	Group Interactions	Social-Cognitive Learning	Pretest	Posttest	Amount of Improvement
Group Interactions	1				
Social-Cognitive Learning	0.62**	1			
Pretest	0.20*	0.21*	1		
Posttest	0.58**	0.56**	0.32**	1	
Amount of Improvement	0.42**	0.43**	-0.15	0.71**	1
* Significant at 0.05 level; ** Significant at 0.01 level					

Simple regression analysis (Table 10) demonstrated that group interactions explain 38.4% of the variance in social-cognitive learning ($R^2 = 0.384$, $R = 0.62$), and the standardized regression coefficient ($\beta = 0.62$) indicates a strong positive effect of this variable. Regression analysis of variance also confirmed the significance of the model ($F(1,98) = 61.62$, $p < 0.001$).

Table 10
Results of Simple Regression Analysis (Predicting Social-Cognitive Learning Based on Group Interactions)

Predictor Variable	Unstandardized Coefficient (β)	Standardized Coefficient (β)	t-statistic	Significance	R^2	R
Group Interactions	0.88	0.62	7.85	0.001	0.384	0.62
Constant	5.38	-	4.23	0.001		

Therefore, the findings indicate a positive and significant relationship between group interactions and social-cognitive learning. This finding is consistent with Bandura's (1986) social-cognitive learning theory and Johnson and Johnson's (2009) cooperative learning principles, confirming that structured group interactions, peer feedback, and observing others' translation processes constitute the primary context for activating observational learning mechanisms and proxy agency in the Jigsaw method. Overall, these findings confirm that group interactions are a necessary prerequisite for social-cognitive learning, as they transform translation processes from individual understanding to distributed cognition and shape the dual awareness noted by Pym (2023) as simultaneous attention to linguistic accuracy and cultural intent.

5. Discussion

This research demonstrates that the Jigsaw method has transformative potential in translation education for Iranian student-teachers, and its empirical findings are fully consistent with the social-cognitive framework. Results emphasize that Jigsaw is not merely an effective teaching method but also a catalyst for deep cognitive and social development aligned with the requirements of professional translation. The discussion is organized around seven key insights derived from data analysis and connected to theoretical foundations, showing that

this method can simultaneously strengthen translation skills, cognitive practices, group interactions, and active and observational learning mechanisms.

5.1. Confirmed Effectiveness: Jigsaw as a Superior Social-Cognitive Strategy

The remarkable improvement in translation skills confirms the effectiveness of the Jigsaw method. This result is fully aligned with Bandura's (1986) social-cognitive theory, as the Jigsaw structure activates observational learning, cognitive modeling, and proxy agency. Student-teachers gradually internalized professional translation standards by observing peers' problem-solving approaches (such as cultural transfer and resolving linguistic ambiguities), oral reasoning in translation negotiation processes, and collective evaluation, a process consistent with findings from Yuliasri (2014) and Mellinger (2019). Furthermore, the Jigsaw method strengthens metacognitive skills such as self-awareness of activity, performance review, and self-regulation, which are essential for professional translator training.

5.2. Social-Cognitive Interactions: The Driving Engine of Translation Skill Improvement

The strong and significant correlation between social-cognitive learning and translation improvement indicates that the core of the Jigsaw method's effectiveness lies in structured group interactions. Johnson and Johnson's (2009) cooperative learning principles, particularly positive interdependence and promotive interaction, were fully realized in practice, as student-teachers depended on each other's puzzle pieces to understand cultural contexts or find idiomatic equivalents, necessitating constructive feedback and expression of their perspectives.

According to Bandura's (1986) theory, observational learning and cognitive modeling enabled student-teachers to learn new translation strategies from peers' performance and reasoning. The notable strengthening of critical dialogue skills (question 19) also demonstrated that Jigsaw cultivates collective analytical ability beyond individual translation, what Slavin (1995) refers to as distributed social cognition.

5.3. Active Learning: Deepening Cognitive Processing

The significant and relatively strong relationship between active learning and translation skill improvement demonstrates that the dual roles of learning and teaching in the Jigsaw method are key success factors. When students are simultaneously learners (mastering their assigned text section) and teachers (explaining concepts to group members), deeper cognitive processing occurs. This finding is fully consistent with Bonwell and Eison's (1991) active learning model. Expert group activities (deep analysis, text interpretation) and home group activities (collaborative rewriting, consensus building) activate higher-order thinking (analysis, synthesis, evaluation) and consolidate translation principles through procedural repetition in the mind. According to Vygotsky's (1978) sociocultural theory, defending stylistic choices and negotiating meaning during collective synthesis leads to the formation of epistemic cognition and genuine internalization of skills, transforming theoretical knowledge into reliable practical ability.

5.4. Contextual Implementation: Managing Challenges in Iran

This study demonstrates that while implementing the Jigsaw method in Iran is highly effective, it faces challenges such as the time-consuming nature of the process (forming expert groups and peer teaching), the

need for divisible course content into puzzle pieces, and cultural resistance to collaborative learning within hierarchical educational structures. Overcoming these obstacles requires careful planning (such as developing activity-oriented guides) and, more importantly, transforming the instructor's role from an absolute knowledge source to a facilitator, a change directly aligned with Bonwell and Eison's (1991) active learning philosophy and Johnson and Johnson's (2009) promotive interaction principle. Therefore, training instructors to assume facilitative roles is a key condition for successful implementation of this method in Iranian classrooms.

6. Conclusion

This study synthesizes empirical findings within a more scientific framework and examines research results in comparison with existing literature to confirm the transformative role of the Jigsaw method in translation education in Iran. This study establishes the Jigsaw method as a transformative instructional strategy for teaching translation principles to Iranian pre-service students. Empirical evidence demonstrates the significant positive effect of this method on the development of translation skills, with high participant perception scores, substantial effect sizes, and statistical significance. In addition to enhancing linguistic accuracy and fluency, Jigsaw enables deep engagement with complex translation challenges such as cultural transfer, lexical adaptation, and textual coherence, transforming learning into a dynamic and collaborative process. Jigsaw's primary function is based on social-cognitive mechanisms that operationalize Bandura's (1986) observational learning theory and proxy agency. Students acquire strategic competencies through observing peers' problem-solving approaches, articulating reasoning in group negotiations, and receiving constructive feedback. Simultaneously, Johnson and Johnson's (2009) principles of positive interdependence and promotive interaction ensure that specialized knowledge exchange drives skill development. Bonwell and Eison's (1991) active learning is realized through teaching sub-topics to peers, bridging theory and practice. This synergy, combined with pattern alignment in homogeneous groups (Wardhaugh, 2010), makes Jigsaw ideal for Iran's diverse classrooms. However, successful implementation requires overcoming specific challenges including the time-consuming nature of group processes, curriculum redesign to create puzzle pieces, and cultural resistance to peer-based learning. Proposed solutions include instructor training and development of activity-based resources. The present research demonstrates that Jigsaw simultaneously develops translation competencies and teaching skills, playing a key role in the concurrent education of translators and teachers, an area previously less attended to.

This study confirms that Jigsaw's core mechanisms (structured interdependence and peer feedback) improve translation quality, particularly in complex tasks such as cultural transfer, and that strong social interactions in groups enhance motivation and academic persistence alongside translation skills. Furthermore, higher-order cognitive skills such as analysis, evaluation, and collective creativity were strengthened, and textual coherence and message conveyance improved. In the Iranian context, this research has two distinctive features: first, Jigsaw's simultaneous role in translation education and modeling teaching methods for pre-service students, filling a significant gap in translator-teacher training; second, specific implementation barriers including cultural resistance arising from hierarchical educational structures, the need for content redesign, and transformation of the teacher's role, which require strategic localization beyond mere adoption of the method.

The present research has several limitations, including the quasi-experimental one-group pretest-posttest design, which, due to the absence of a control group and random assignment, limits control over confounding variables such as maturation or test-retest effects; and being focused on a single university, which reduces the

generalizability of findings. Accordingly, future researchers are recommended to employ quasi-experimental designs with control groups or true experimental designs with random assignment, consider multi-stage random sampling across different regions of Iran, utilize mixed methods incorporating interviews and structured observation for deeper analysis of social-cognitive processes, examine Jigsaw's effect on mediating variables such as translation self-efficacy through structural equation modeling, and design longitudinal studies to assess the long-term sustainability of this method's impact, thereby revealing deeper pathways of self-efficacy development within Bandura's (1986) framework. Additionally, conducting action research for localizing the Jigsaw method in Iran's educational context and comparing its effectiveness with other cooperative learning methods are further recommendations of this study.

Declarations

Funding

No funding was received for conducting this study.

Conflicts of interest/Competing interests

The authors declare no conflict of interest. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report.

Availability of data and material

The datasets analyzed during the current study are available. Additional data and materials are available upon request from the first author.

Authors' contributions

All authors contributed to the design of the study, data collection, analysis and interpretation of the results, and drafting of the manuscript. All authors read and approved the final manuscript.

Ethics approval

This research study was conducted in accordance with the APA ethical guidelines and approved by the Research Ethics Board of Farhangian University, Kerman, Iran. Informed consent was obtained from all human participants included in the study.

Consent to participate

A pre-requisite formal permission was sought from the participants.

Consent for publication

Appropriate consent for publication was sought.

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