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The Effect of Different Components of the Brainling Model on EFL Learners' Recall and Retention of Complex Structures: An Experimental Approach

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ABSTRACT

Objective: Contrary to the importance of recall and retention of complex structures in language performance, they are difficult for EFL learners. To reduce EFL learning difficulties, different strategies have been put forth. This study examined the effect of different components of the Brainling Model (i.e., cultuling, cogling, sensoling, and emoling) on EFL learners' recall and retention of complex structures.

Methods: To this end, a quasi-experimental pre-test post-test control group design was used. The participants included five groups including four experimental groups and one control group who were selected through convenience sampling in the form of five lower-intermediate intact female classes of 30 students from a private language institute in Kerman, Iran. The Oxford Placement Test (QOPT) and two multiple-choice tests of relative clauses were used for data collection.

Results The results showed that the Brainling Model and its components (i.e., cultuling, cogling, sensoling, and emoling) had a significant effect on EFL learners' recall and retention of complex structures. Also, it was shown that cultuling was the most effective component on EFL learners' recall and retention of complex structures.

Conclusions: The Brainling Model along with its components can be used at the service of enhancing recall and retention in EFL learners. Moreover, it is concluded that cultuling component of the Brainling Model can be used as a more effective component than other components in equal conditions to improve learners' recall and retention. Therefore, cultural elements are recommended to be injected into learning materials to help learners recall and retain complex structures. The findings have some implications for EFL teachers, material developers and learners.

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Introduction

Complex structures cover various linguistic structures such as relative clauses (RCs), passive structures, modal verbs, etc. that help learners express complex things efficiently (Ellis, 2008; Rashidi & Babaie, 2013). Complex structures are too difficult for EFL learners because they are a built out of merge of clauses or simpler clauses (i.e., dependent or independent) through coordination and embedding (DeKeyser, 2005). Learning complex structures, recalling and retaining theme is a sign of general language development (Lau & Shea, 2022). Recall is equivalent to retrieval of materials stored in the memory. As a fundamental aspect of EFL learning, recall involves bringing previously stored materials in the memory into awareness (Alrayah, 2018). Retention, according to Edwards (2011), refers to storing the encoded data in the brain. It also refers to fixation of the improvement in the learning of a skill with no practice.

Contrary to the importance of recall and retention of complex structures in general and RSs in particular in language performance, they are difficult for EFL learners. To reduce EFL learning difficulties, different strategies have been put forth. Recently, some new approaches have been proposed to make EFL learning easier for learners. One of these approaches is Brainling Model which seems promising in solving some problems of EFL learners with language learning (Pishaghadm & Ebrahimi, 2020). Pishaghadm and Ebrahimi (2020) designed Brainling Model based on function of brain in language, and the importance of thinking, senses, emotion and culture in social interactions and consequently language learning. In this model, with emphasis on some issues like, language and thinking, language and emotion, language and sense, and language and culture, some new components such as cogling, cultuling, emoling, and sensoling are introduced. All aim to showcase how brain functions work together with language learning. The concept of Cogling which is an important part of Brainling Model and effective communication represents the cognitive processes associated with language use. Cognitive style or "thinking style" is a term used in psychology to define the way individuals think, perceive and remember information (Bagheri Masoudzade & Fatehi Rad, 2022). It parallels the Theory of Mind, a psychological construct that explains how individuals perceive and interpret the mental states of others including their emotions, beliefs, and intentions. Emoling, a term coined by Pishghadam and Ebrahimi (2020), refers to the emotional weight carried by language and its influence on mood and interpersonal dynamics. This concept distinguishes between internal emotions which are

instinctive and automatic such as pain and external emotions which are shaped by social and environmental factors. The concept of Cultuling, or the culture of language, emphasizes the role of language in reflecting and transmitting the cultural values and norms of a society. As Pishghadam and Ebrahimi (2020) argued, language is not only a tool for communication but also a carrier of cultural identity. They also described Sensoling as the process by which individuals connect with their environment through sensory channels which in turn influence both verbal and non-verbal communication. The ability to interpret and respond to sensory stimuli accurately is essential for effective communication, as heightened sensory awareness enhances one's ability to gather information and make sense of the world around them. By clarifying how the model relates to language learning, it helps to provide a theoretical framework for the current study and supports its experimental purpose, which is to identify which, if any, of the framework components is most effective for supporting Iranian EFL learners' ability to accurately recall and retain complex grammatical structures.

The theoretical framework of this study is centered around the Brainling Model which is a cognitive-linguistic framework developed by Pishghadam and Ebrahimi (2020). The Model's emphasis on managing mental effort can also be understood through the lens of Cognitive Load Theory (Sweller, 1988), which posits that working memory has a limited capacity and that instructional design should aim to optimize intrinsic, extraneous, and germane cognitive load.This model draws inspiration from MacLean's (1978) seminal Triune Brain Theory. MacLean's theory proposes that the human brain is composed of three evolutionary components, each corresponding to different stages of brain development which are the Reptilian Complex (R-Complex), the Limbic System, and the Neocortex. Each of these components plays a distinct role in human behavior and cognitive functioning and contribute to the complex interplay of instinct, emotion, and higher-order thinking that characterizes human experience. The model in question notably aligns with Tomasello's (1999) version of cultural transmission in which humans learn, not only by independently figuring things out, but through engaging in collective activities, imitation, and instruction. Recognizing the interaction among teacher scaffolding, learner agency, and social interaction, the Brainling Model stays true to the evolutionary origins of education ethical as a form of cumulative cultural learning. This association emphasizes the model's significance not only for present-day educational contexts but also for understanding how teaching methods

leverage fundamental human abilities related to collaborative communication, symbolic reasoning, and emotional synchronization.

Recently, work in second language acquisition (SLA) has moved away from exploring only linguistic or structural theories of learning to looking at the interactive roles of cognition, emotion and social context. Emotion-focused research which has rooted in the positive psychology movement in SLA, reveals that positive affect (i.e., enjoyment, interest, well-being) opens up attention and generates cognitive resources that facilitate L2 learning, while specific emotions, like anxiety or facilitating anxiety, may differentially engage approach/avoidance behaviors to classroom-based tasks, etc. In fact, MacIntyre and Gregersen (2012); validation work in Dewaele et al., (2019) provide a collection of arguments and empirical studies under positive psychology in SLA. The Brainling Model which explicitly foregrounds cognition (cogling), emotion (emoling), culture (cultuling), and senses (sensoling) maps directly and simply onto contemporary work. In essence, the Brainling Model is novel which connects emotional engagement and multi-modal/sensorial elements with cognitive processing and socio-cultural context. Recent studies of Brainling--both methodologically and on validation--indicate Brainling can predict different engagement and recall for complex structures when the lessons intentionally manipulate emotional salience and multimodal supports (Pishghadam & Ebrahimi, 2020; Sanatipour, 2024). Pishaghadm and Ebrahimi (2020) believe that through relying on functions of brain, this model can help EFL learners better learn EFL materials. Therefore, it may also be effective on grammar learning and learning complex structures. However, because this model is recently proposed, the volume of studies on it is scarce. Accordingly, this study seeks to investigate the effect of Brainling Model on Iranian EFL learners' recall and retention of complex structures.

The specific syntax of complex structures makes them difficult for EFL learners. Accordingly, EFL learners neglect them or do not use them in their production or comprehension of language structures. This is while complex structures are inevitable aspects in language development. In Iranian context, wherein language exposure is low, recall and retention of complex structures is really challenging for learners (Farhangi & Pourmohammadi, 2018). There exist different types of complex structures in English language which are difficult to be learned among which RCs can be referred to. Several researchers have noted the difficulty of learning RCs in EFL contexts (e.g., Abdolmanafi & Rahmani, 2012; Marefat & Abdollahnejad, 2014). RCs are structures wherein one

sentence is embedded in another sentence when the two sentences share a co-referential noun or noun phrase. A RC should always be located right after the noun which it modifies. In sum, recall and retention of RCs are difficult for EFL learners and various strategies should be tried to reduce the difficulty of recalling and retaining them.

In the Iranian EFL context, the difficulties of learning and recalling complex grammatical structures are exacerbated for a variety of contextual and instructional reasons. Unlike learners in ESL contexts, EFL learners in Iran are exposed to English almost exclusively in the classroom, with virtually no authentic communicative context outside the school environment (Ghorbani, 2009). The restricted input diminishes opportunities for acquiring complex forms naturally, including relative clauses, the passive voice, and modal verbs, and requires learners to rely on explicit instruction and memorization (Papi, 2010). Additionally, grammar-focused curricula in Iran tend to prioritize grammar accuracy and the explicit use of grammatical forms, which may further contribute to learners being unable to access or retain complex grammatical structures when 'real-time' communicative use occurs (Shahsavari, 2014). As such, Iranian learners may find it more difficult to retain and quickly recall what they have learned, especially when compared to learners in contexts with more exposure to English media and interaction. Given these challenges, there seems to be room for more innovative pedagogy, including the use of the Brainling Model as an alternative for limited input, while offering the opportunity to create deeper cognitive, emotional, sensory, and even cultural engagement into the process of language learning.

Considering previous studies, Sanatipour et al. (2024) conducted an evaluation of two widely used English textbooks in Iran, using a Brainling-based scale. They reported significant differences in the representation of Brainling elements in the textbooks. In the foreign context, Khavatan et al. (2022) explored whether priming could lead to short- and long-term improvements in EFL learners' ability to produce relative clause (RC) structures. They reported that learners' ability to produce relative clauses showed a descriptive improvement shortly after the priming intervention, as well as over time. However, inferential analysis did not indicate any statistically significant improvement in the short- or long-term production of RC structures. In the same year, Sadeghi et al. (2022) investigated the impact of two teaching techniques, namely textual input enhancement (TIE) and learners' output production (LOP) both individually and in combination on students' noticing and acquisition of English relative clauses (RCs. The results indicated that LOP had a

positive impact on both noticing and learning RCs, whereas TIE was effective in enhancing noticing but did not significantly improve learning outcomes. In the same vein, Pishghadam and Ebrahimi (2020) aimed to explore the concept of postlocution, a level that goes beyond traditional communicative competence, and introduced the concept of brainling, which is grounded in brain structures. In this framework, it is suggested that, along with focusing on self-directed language, communication should also prioritize language oriented toward others. Furthermore, individuals are encouraged to develop both communicative competence and linguo-therapeutic competence, using language to improve their overall well-being.

Among the more recent pedagogical frameworks, the Brainling Model, which integrates neuroscientific principles with language teaching seems to be gaining attention. Yet, empirical research on its effectiveness in the specific context of EFL learners' development of complex structures is not explored. The existing literature has primarily focused on the model's broader applications. This has left a gap in understanding how it might influence the learning of syntactically demanding forms like relative clauses. Additionally, much of the research concerning recall and retention of relative clauses has been conducted in Western educational settings which may not be fully applicable to non-Western EFL contexts, such as Iran, where cultural and linguistic differences can significantly impact language learning. The unique linguistic challenges faced by Iranian learners such as the absence of certain syntactic structures in Persian that correspond directly to English relative clauses necessitate a context-specific exploration of pedagogical models. While a few studies have examined Iranian EFL learners' difficulties with relative clauses none have addressed how innovative teaching frameworks like the Brainling Model could mitigate these challenges. More importantly, the Brainling Model, as claimed by its designers, has the potential to make language learning easier for EFL learners. But because this model has been newly proposed in the field of Teaching English as a Foreign Language (TEFL), it has not been investigated in terms of its effectiveness on English grammar learning. More specifically, no previous study, to the best knowledge of the researcher, has addressed the effect of the Brainling Model and its components on EFL learners' recall and retention of complex structures. To fill this gap, this study aims to explore this issue experimentally. To this end, the following research questions were formulated:

1. Does Brainling Model (cultuling, cogling, sensoling, & emoling) significantly affect Iranian EFL learners' recall and retention of complex structures?
2. What is the most effective component of the Brainling Model on Iranian EFL learners' recall and retention of complex structures?

Material and Methods

To conduct this study, a quasi-experimental pre-test post-test control group design was followed (Ary et al., 2010). The study recruited five groups including four experimental groups and one control group. They were selected through convenience sampling in the form of five lower-intermediate intact female classes of 30 students from a private language institute in Kerman, Iran, wherein the researcher was already teaching English. In educational research, especially within private institutes, researchers often face restrictions that prevent random assignment or broad recruitment. Working with intact classes reduces disruption to the regular learning setting, guarantees practicality, and provides access to participants who are already arranged into instructional groups. Although these choices are practical, they restrict the ability to generalize the findings beyond this particular group. The outcomes may mainly pertain to females within comparable educational settings, and care should be taken when applying these conclusions to male students, mixed-gender environments, or other age categories.

The homogeneity of the participants was checked through quick Oxford Placement Test (QOPT). That is, those whose scores fell in the range of 10-19 were picked up to participate in the study. Four classes were randomly assigned into the four experimental groups and one class into the control group. They were in the age range of 11-14. In adherence to ethical guidelines, explicit consent was secured from the participants, ensuring their voluntary participation in the study. It should be explicitly mentioned that consent was acquired from their parents or guardians, alongside the agreement from the students themselves, in accordance with ethical guidelines for conducting research involving minors. In fact, they received a comprehensive information sheet that described the study's objectives, methods, possible risks, and anticipated advantages. Written consent forms were gathered, and participants were provided with age-appropriate clarifications regarding their right to withdraw from the study at any time without consequence. More

importantly, the participants were guaranteed the confidentiality and anonymity of their information. They were also informed of the objectives of the study.

The QOPT was used at the outset of the study to homogenize the participants. It consists of 40 multiple choice items of grammar, vocabulary and cloze test developed and validated by Oxford University Press and the Cambridge ESOL Examination Syndicate.

A multiple-choice test of RCs was developed by the researcher in 30 items to be used as the recall pre-test and post-test. This test was developed based on the content of the English textbook (i.e., American English Files) already taught in the language institute which is the setting of the study. To ensure content validity, five ELT experts reviewed the test to confirm that the items were representative of the target structures and appropriate for learners' proficiency level. Apart from the expert review, some statistical analyses were conducted. An item analysis was carried out to ascertain the item facility (difficulty) and item discrimination, ensuring that each item sufficiently discriminated between high- and low-performing learners. Reliability of the test was checked through Cronbach's Alpha test .87.

A multiple-choice test of RCs was designed by the researcher in 30 items to be employed as the retention test. This test was run in the form of a delayed post-test one month after recall post-test. This test was designed based on the content of the English textbook (i.e., American English Files) already taught in the language institute which is the setting of the study. To confirm the test validity, expert judgment was used by getting five ELT experts' comments on the test. Moreover, by checking content validity the researchers ensured that the test items comprehensively and proportionately represent the learning objectives and language skills emphasized in the instructional materials. Each test item linked to specific lessons and, language structures covered in the textbook and frequently taught material was adequately represented. The researchers also administered the test to a small group of learners to obtain information on item clarity, difficulty, and whether any content areas are under- or over-represented. Considering judgements, inter-rater agreement among the experts was calculated to assess the reliability of their judgments. Analyzing the data indicated a high level of consistency, which supported the robustness of the validation process. This step ensured that the instruments both assessed the intended constructs and represented professional agreement on their appropriateness. Finally, reliability of the test was checked through Cronbach's Alpha test .91.

Data Collection and Analysis Procedure

To gather the necessary data, data collection began after the appropriate sampling procedures were executed. To this end, first, the participants were homogenized using the QOPT followed by the administration of recall pre-test. Then, the treatment period started wherein each experimental group was exposed to instructional materials based on one component of the Brainling Model in 10 sessions held twice a week in 90 minutes. For instance, in the cogling group, educational materials were presented to the class in a sequence from easy ones to complex ones, by covering different language skills. The teacher started from basic materials and moved to more complex ones. In this path, she taught all language skills. She tried to regulate the learning materials according to learning pace and readiness of the learners. In the emoling group, educational materials interesting and emotional for learners and appropriate for their age and proficiency level were used. In so doing, the teacher asked the learners to choose the educational materials they liked. Moreover, she considered the age of the learners in selecting the materials. Also, she took the proficiency level of them into account in material selection so that the materials are not difficult for them. In the sensoling group, the materials were selected that activate five senses of learners. For example, the teacher provided some tools to the learners and asked them to touch it and guess what things they are. Besides, she showed a voice-less video to the learners and asked them to guess its meaning just by watching it. Or she asked them to taste some foods with closed eyes and say what it is. Finally, in the cultuling group, the authentic materials and those related to different cultures were used in the class. To this, the teacher benefited from multicultural materials so that the learners become acquainted with different cultures. Additionally, she tried to use realistic materials in the class to help the learners become engaged in the learning process. That is to say, some news articles, short stories, video clips and advertisements were provided and the students were integrated into some classroom activities like discussion prompts, role-plays, storytelling, comparative cultural analysis tasks, etc. However, in the control group, the mainstream teaching method used in the institute was employed. That is, the above activities and procedures were not used in this group (control) at all. The teaching procedures used in this group were those usually followed by the teachers in line with the textbook and sequence of materials provided in it. The researcher herself taught in all the groups. One week after the end of treatment period, recall post-test was run. One month later, retention test was run in the form of a delayed post-test. The data

collected in this study was analyzed through One-Way ANCOVA, and Repeated Measures ANOVA which, besides their own specific assumptions, require normality of the data.

It should be noted that ensuring objectivity is a vital aspect of rigorous research design, especially when a researcher holds a dual role that may influence the data. Standardized protocols help minimize variability in the way interventions, instructions or assessments are delivered. In the current research, the same procedures were used consistently across participants. Another common measure was blinding, in which participants and evaluators were kept unaware of aspects of the research design. In addition, standardized teaching materials were employed. Standardization improves consistency and minimizes the likelihood of favoring particular participants or adjusting of procedures without intentionality as a result of expectations. In the present research identical instructions, activities, and resources for all the participants were used which minimized the effect of researcher discretion or variation in delivery.

Results

The first major research question and its four minor ones aimed at investigating the effect of components of Brainling Model on the recall of complex structures among Iranian EFL learners. One-Way ANCOVA was run see how five groups performed differently on complex structures posttest after controlling for the pretest effect.

One-Way ANCOVA, besides the assumptions of normality, and reliability which were checked and fulfilled, has three more assumptions that are checked below. First, One-Way ANCOVA assumes a linear pretest-posttest relationship. The significant results of the linearity test (as shown in Table 1) ($F (1, 149) = 109.92$, $p < .05$, eta squared = .483) show that this assumption was met.

Table 1. Testing linearity assumption

			SS	DF	MS	F	P
Posttest * Pretest	Between Groups	(Combined)	3144.745	22	142.943	5.398	.000
		Linearity	2910.981	1	2910.981	109.923	.000
		Deviation from Linearity	233.764	21	11.132	.420	.988
	Within Groups		3363.228	127	26.482		
	Total		6507.973	149			

Second, One-Way ANCOVA assumes homogeneity of regression slopes. The non-significant interaction between covariate (pretest), and the independent variable (as seen in Table 2) (F (1, 140) = .324, p > .05, Partial eta squared = .009) indicated that this assumption was met.

Table 2. Testing the assumption of homogeneity of regression slopes

Source	SS	DF	MS	F	P	Partial Eta Squared
Group	417.528	4	104.382	9.240	.000	.209
Pretest	3050.879	1	3050.879	270.067	.000	.659
Group * Pretest	14.646	4	3.662	.324	.861	.009
Error	1581.547	140	11.297			
Total	58700.000	150				

Finally, One-Way ANCOVA assumes homogeneity of variances of the groups. The significant results of the Levene's tests (F (4, 145) = 3.23, p < .05) (as indicated in Table 3) indicated that this assumption was not met. However, there is no need to worry about the violation of this assumption because if groups enjoy equal sample sizes, as is the case in this study, the significant results of the Levene's test can be ignored.

Table 3. Results of the Levene's test

F	DF1	DF2	P
3.236	4	145	.014

Table 4 shows the five groups' posttest means after controlling for the pretest effect. According to the results, the cultuling group (M = 24.13, SE = .613) had the highest mean on posttest of complex structures. This was followed by cogling (M = 20.49, SE = .609), sensoling (M = 18.91, SE = .609), emoling (M = 16.38, SE = .609), and control (M = 13.33, SE = .608) groups.

Table 4. Descriptive statistics for posttest of complex structures by group with pretest

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Cultuling	24.134[a]	.613	22.923	25.345
Cogling	20.491[a]	.609	19.287	21.695
Sensoling	18.919[a]	.609	17.716	20.122
Emoling	16.386[a]	.609	15.183	17.589
Control	13.337[a]	.608	12.134	14.539

In Table 4, the results of One-Way ANCOVA are shown. The results (F (4, 144) = 45.12, p < .05, partial η2 = .556) indicated that there were significant differences between the five groups' means on posttest of complex structures after controlling for the effect of pretest. Thus, it can be

concluded that different components of the Brainling Model significantly affect Iranian EFL learners' recall of complex structures.

Table 5. The results of one-Way ANCOVA

Source	SS	DF	MS	F	P	Partial Eta Squared
Pretest	3098.007	1	3098.007	279.486	.000	.660
Group	2000.799	4	500.200	45.125	.000	.556
Error	1596.193	144	11.085			
Total	58700.000	150				

The significant results of One-Way ANCOVA (as indicated in the Table 5) were followed by post-hoc comparison tests (Table 6) in order to probe the four minor research questions. Based on these results, and the means shown in Table 4.4, the cultuling group (M = 24.13) significantly outperformed the control group (M = 13.33) on posttest of complex structures, controlling the pretest effect (MD = 10.79, $p < .05$). Thus, it is concluded that cultuling component of Brainling Model significantly affects Iranian EFL learners' recall of complex structures. Moreover, it was shown that the cogling group (M = 20.49) significantly outperformed the control group (M = 13.33) on posttest of complex structures, controlling the pretest effect (MD = 7.15, $p < .05$). Thus, cogling component of Brainling Model significantly affects Iranian EFL learners' recall of complex structures.

Table 6. Post-hoc comparison tests for posttest of complex structures by groups with pretest

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Cultuling	Cogling	3.643*	.867	.000	1.172	6.115
	Sensoling	5.215*	.866	.000	2.745	7.685
	Emoling	7.748*	.866	.000	5.278	10.219
	Control	10.797*	.861	.000	8.342	13.252
Cogling	Sensoling	1.572	.860	.696	-.879	4.023
	Emoling	4.105*	.860	.000	1.654	6.556
	Control	7.154*	.862	.000	4.697	9.611
Sensoling	Emoling	2.533*	.860	.037	.083	4.984
	Control	5.582*	.862	.000	3.126	8.039
Emoling	Control	3.049*	.862	.005	.592	5.505

Furthermore, the sensoling group (M = 18.91) significantly outperformed the control group (M = 13.33) on posttest of complex structures, controlling the pretest effect (MD = 5.58, $p < .05$). Thus, sensoling component of Brainling Model significantly affects Iranian EFL learners' recall of complex structures.

Finally, the emoling group (M = 16.38) significantly outperformed the control group (M = 13.33) on posttest of complex structures after controlling for the effect of pretest (MD = 3.04, $p < .05$). Thus, emoling component of Brainling Model significantly affects Iranian EFL learners' recall of complex structures. With regard to the most effective component of the Brainling Model on Iranian EFL learners' recall of complex structures, the Table 4.10 shows that the highest mean belonged to the cultuling group (M = 22.86). Accordingly, cultuling was the most effective component of the Brainling Model on Iranian EFL learners' recall of complex structures.

The second major research question and its four minor ones aimed at investigating the effect of components of Brainling Model on the retention of complex structures among Iranian EFL learners. Repeated Measures ANOVA plus Simple Effect Analysis (SEA) were run to probe the second major research question, and the minor ones related to it. These statistical techniques enabled the researchers to compare each experimental group's mean change from posttest to delayed posttests of complex structure. Repeated Measures ANOVA has four assumptions; i.e., normality of data (which was checked and fulfilled), homogeneity of variances of groups, homogeneity of covariance matrices, and sphericity whose results are discussed below.

First, Repeated Measures ANOVA requires that the groups should enjoy homogenous variances on pretest and posttest of complex structures. Table 7 shows the results of the Levene's test of homogeneity of variances. The results showed that the assumption of homogeneity of variances was retained posttest of complex structures ($F (3, 116) = .730$, $p > .05$); however, it was violated on delayed posttest ($F (3, 116) = 3.13$, $p < .05$). As it was mentioned earlier, since the groups enjoyed equal sample sizes, there was no need to worry about the violation of this assumption.

Table 7. Results of the Levene's test

		Levene Statistic	DF1	DF2	P
Posttest	Based on Mean	.784	3	116	.505
	Based on Median	.730	3	116	.536
	Based on Median and with adjusted df	.730	3	107.972	.536
	Based on trimmed mean	.787	3	116	.503
Delayed	Based on Mean	3.558	3	116	.017
	Based on Median	3.138	3	116	.028
	Based on Median and with adjusted df	3.138	3	109.126	.028
	Based on trimmed mean	3.622	3	116	.015

Second, Repeated Measures ANOVA requires that the correlations between posttest and delayed posttest of complex structures be roughly equal across the four groups; i.e., homogeneity of covariance matrices. This assumption was examined through the Box's Test. As shown in Table 4.8, the significant results of the Box's test (Box's M = 41.14, $p < .001$) indicated that the assumption of homogeneity of covariance matrices was not retained. There is no need to worry about the violation of this assumption. As noted by Field (2024, p. 800), "If sample sizes are equal then people tend to disregard Box's test, because (1) it is unstable, and (2) in this situation we can assume that Hotelling's and Pillai's statistics are robust". It is worth mentioning that Field (2024), Pallant (2016), and Tabachnick and Fidell (2019) believe that the results of the Box's tested should be reported at .001 levels.

Table 8. Test of Equality of Covariance Matrices for

Box's M	41.145
F	4.429
df1	9
df2	154203.164
Sig.	.000

Finally, Repeated Measures ANOVA requires sphericity of the data; as examined through the Mauchly's test. As noted by Field, 2024; at least three conditions (tests) are needed in order to compute the Mauchly's test. Since this study included two tests; i.e., posttest and delayed posttest of complex structures, Mauchly could not compute its probability (Table 9). The column named "Sig." has a dot, instead of probability values.

Table 9. Mauchly's Test of Sphericity

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	DF	P	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
complex structures	1.000	.000	0	.	1.000	1.000	1.000

After discussing the assumptions related to Repeated Measures ANOVA, the main results will be reported below. Table 10 shows the four groups' means on posttest and delayed posttest of complex structures. The results indicated that none of the group showed large increase or decrease in their mean scores from posttest to delayed posttest. If the mean scores on posttest of complex

structure are different from the ones reported in the Table 4, it should be noted that the mean scores in Table 4 were corrected for the effect of pretest.

Table 10. Descriptive statistics for posttest and delayed posttest of complex structures by group

Group	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Cultuling	Posttest	22.867	1.038	20.810	24.923
	Delayed	22.600	1.050	20.520	24.680
Cogling	Posttest	21.100	1.038	19.044	23.156
	Delayed	20.767	1.050	18.687	22.846
Sensoling	Posttest	19.467	1.038	17.410	21.523
	Delayed	19.867	1.050	17.787	21.946
Emoling	Posttest	16.933	1.038	14.877	18.990
	Delayed	16.600	1.050	14.520	18.680

Table 11 shows the results of Between-Subjects Effect. The results ($F (3, 116) = 5.89$, $p < .05$, partial eta squared = .132 representing a moderate effect size) indicated that there were significant differences between the four groups' overall means on posttest and delayed posttest of complex structures. That is to say, if the sum of scores on posttest, and delayed posttest are computed, there will be significant differences between the four groups' means on the total test.

Table 11. Tests of between-subjects effects for overall posttest and delayed posttest of complex structures by group

Source	SS	DF	MS	F	P	Partial Eta Squared
Intercept	96240.150	1	96240.150	1500.814	.000	.928
Group	1134.317	3	378.106	5.896	.001	.132
Error	7438.533	116	64.125			

Table 12 shows the results of Within-Subject Effects. The results indicated that there was not any significant difference between the overall means on posttest and delayed posttest of complex structures irrespective of group membership ($F (1, 116) = .824$, $p > .05$, partial eta squared = .007 representing a weak effect size). That is to say, if the total samples' means on posttest and delayed posttest of complex structures are compared, there will not be any significant difference between the two overall means. Based on these results, it can be concluded that the Iranian EFL learners did not show any significant decrease in their means on complex structure from posttest to delayed posttest. Thus; the second major null-hypothesis as "different components of the Brainling Model did not significantly affect Iranian EFL learners' retention of complex structures" was supported. The results shown in the Table 12 also indicated that there was not any significant interaction

between groups and time of tests; i.e., posttest and delayed posttest (F (1, 116) = 1.47, p > .05, partial eta squared = .037 representing a weak effect size).

Table 12. Tests of Within-Subjects effects for overall pretest and posttest of complex structures by group

Source		SS	DF	MS	F	P	Partial Eta Squared
Time	Sphericity Assumed	.007	.824	1	116	.366	.007
	Greenhouse-Geisser	.993	.824	1	116	.366	.007
	Huynh-Feldt	.007	.824	1	116	.366	.007
	Lower-bound	.007	.824	1	116	.366	.007
Time * Group	Sphericity Assumed	.037	1.476	3	116	.225	.037
	Greenhouse-Geisser	.963	1.476	3	116	.225	.037
	Huynh-Feldt	.038	1.476	3	116	.225	.037
	Lower-bound	.038	1.476	3	116	.225	.037

Table 13 shows the results of the Simple Effect Analysis which compared the four groups' mean increase or decrease from posttest to delayed posttest of complex structures. The results indicated that there was not any significant difference between cultuling group's means on posttest (M = 22.86) and delayed posttest (M = 22.60) of complex structures (MD = .267, p > .05). Since the cultuling group did not show any significant decrease in their mean score from posttest to delayed posttest, it was concluded that cultuling component of Brainling Model enabled Iranian EFL learners to retain their knowledge of complex structures from posttest to delated posttest. Thus, cultuling component of Brainling Model significantly affects Iranian EFL learners' retention of complex structures.

Besides, there was not any significant difference between cogling group's means on posttest (M = 21.10) and delayed posttest (M = 20.76) of complex structures (MD = .333, p > .05). Since the cogling group did not show any significant decrease in their mean score from posttest to delayed posttest, it was concluded that cogling component of Brainling Model enabled Iranian EFL learners to retain their knowledge of complex structures from posttest to delayed posttest. Thus, cogling component of Brainling Model significantly affects Iranian EFL learners' retention of complex structures.

Table 13. Simple effect analysis for posttest and delayed posttest of complex structures by group

Group	(I) Post	(J) Delayed	Mean Difference (I-J)	Std. Error	P	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Cultuling			.267	.294	.366	-.315	.849
Cogling			.333	.294	.259	-.249	.915
Sensoling			.400	.294	.176	-.182	.982
Emoling			.333	.294	.259	-.249	.915

Moreover, there was not any significant difference between sensoling group's means on posttest (M = 19.48) and delayed posttest (M = 19.88) of complex structures (MD = .400, p > .05). Since the sensoling group did not show any significant decrease in their mean score from posttest to delayed posttest, it was concluded that sensoling component of Brainling Model enabled Iranian EFL learners to retain their knowledge of complex structures from posttest to delayed posttest. Thus, sensoling component of Brainling Model significantly affects Iranian EFL learners' retention of complex structures.

Finally, there was not any significant difference between emoling group's means on posttest (M = 16.93) and delayed posttest (M = 16.60) of complex structures (MD = .333, p > .05). Since the emoling group did not show any significant decrease in their mean score from posttest to delayed posttest, it was concluded that emoling component of Brainling Model enabled Iranian EFL learners to retain their knowledge of complex structures from posttest to delayed posttest. Thus, emoling component of Brainling Model significantly affects Iranian EFL learners' retention of complex structures. With regard to the most effective component of the Brainling Model on Iranian EFL learners' retention of complex structures, the Table 10 shows that the highest mean belonged to the cultuling group (M = 22.60). Accordingly, cultuling was the most effective component of the Brainling Model on Iranian EFL learners' retention of complex structures.

Discussion

Regarding the proposed research questions, the results demonstrated that the Brainling Model and its components (i.e., cultuling, cogling, sensoling, and emoling) significantly influenced Iranian EFL learners' recall and retention of complex structures. In particular, cultuling emerged as the most effective component in enhancing recall. Similarly, with respect to retention, the findings revealed that the Brainling Model and its components significantly improved learners' long-term retention of complex structures, with cultuling again showing the greatest impact.

These findings support the Brainling Model's theoretical assumptions of cognition, culture, senses, and emotions being highly influential for the brain to advance and embody language (Pishghadam & Ebrahimi, 2020). The significant effect of cogling supports the assertion that engaging a learner's thinking and reasoning systems helps them process complex grammatical input and allows them to more easily retrieve and apply forms that can be learned. The positive effect of emoling provides evidence for the model's assertion about emotions, as learners who experienced decreased anxiety and greater positive emotions toward the learning process recalled and retained more complex structures than learners who did not experience these positive emotions. The role of sensoling also supports the model's premise that multisensory input leads to better encoding and strengthened memory traces to be utilized to foster both immediate recall and longer-term retention. Finally, the significant effect of cultuling supports the model's cultural dimension, suggesting that when complex structures are embedded within contexts that are meaningful to learners' cultures, learners enjoy higher motivation and engagement, as well as construct more personal connections, which can all lead to improved recall and retention of grammatical accuracy.

The findings from this research also imply that the Brainling Model does not simply minimize surface-level difficulty but triggers cognitive mechanisms that are deeper, such as attention, reasoning, and problem-solving, which helped the learners better organize and internalize complicated grammatical structures. Additionally, the learners in the experimental groups demonstrated higher engagement and autonomy, as observed in their ability to apply relative clauses outside the tasks of the pre-test and post-test. Enhancement of learners' control over language structures under the effect of the Brainling Model and their autonomy can also be enumerated as mediating factors. This evidence offers additional support for Pishghadam et al.'s (2013) claim that the components of Brainling, in turn, facilitate more durable learning by privileging the learners' control over their own cognitive or emotional engagement with the input. The greater effectiveness of cultuling specifically underscores the case for embedding grammar learning within culturally-rich contexts. It appeared that embedding culture stimulated learner curiosity and motivation and prompted a wider range of emotional responses that, in turn, led to a deeper and more nuanced understanding of complex structures. This finding is consistent with Pishghadam et al. (2016), who argue that culture-based learning engenders highly vivid mental imagery, and leads to a more substantial sense of belonging, as part of the target language

community. In this way, the study provides empirical support for the theoretical suggestion (Brainling Model), that culture is another feature (alongside cognition, emotion, and sensory input) that is a powerful mediator of successful language learning.

In comparing the results with previous studies, it is necessary to recognize that this research is the first one to investigate the Brainling Model with respect to recall and retention of grammatically complex structures. Therefore, there are only limited comparisons to be drawn; however, several studies have researched the Brainling Model or its components in language learning endeavors. For example, Demirel (2010), Esmaili (2011), Johansson (2009), Nazeri (2010), Paivandi (2008), and Stockdale (2006) found components of the Brainling Model created positive learner attitudes, which led to language learning. While these studies echo the results of the present study regarding using the Brainling Model to improve language learning outcomes, they were largely based on general learner attitudes and motivation and did not focus on learning grammatically complex structures, as examined in the current study. The current study expands upon what is known by suggesting that positive attitudes can lead to observable cognitive development regarding learners' recall and retention of relative clauses, which are inherently difficult for EFL learners. Similarly, in the studies by Aratemur Çimen and Bayhan (2019), Bouzid (2019), and Zhang (2014), emotional and cognitive load of learning input enhances learning output significantly. Finally, in accordance with the studies by Khany and Ghasemi (2018), Nazari and Karimpour (2022), Pishghadam (2015), Pishghadam et al. (2013, 2016), and Pishghadam and Mirzaee (2008), if emotions, cognition, senses and sensory emotions are taken into account in preparing EFL educational materials, language achievement of learners is remarkably enhanced.

Likewise, Aratemur Çimen and Bayhan (2019), Bouzid (2019), and Zhang (2014) showed that decreasing cognitive and emotional load can lead to positive outcomes in second language learning. All of these, however, studied input-output relationships based on vocabulary, listening comprehension and general proficiency. The present study differentiates in that the Brainling Model engages input processing, in addition to syntactic integration, where learners must simultaneously maintain multiple clauses and dependencies, which is a critical difference to note. Because grammar learning, especially with sentences that have more complex structures, draws on higher levels of working memory engagement and longer retention strategies, which is less relevant in vocabulary or comprehension tasks.

In terms of methodological contrast, previous studies have commonly used surveys or self-reports to assess different views, whereas this study used objective recall and retention tasks of relative clauses. This design choice adds empirical weight to the argument that the Brainling Model does more than influence affective factors. It also strengthens learners' grammatical competence. This is especially relevant in the Iranian EFL context in which their exposure to authentic English input outside of formal instructional settings is quite limited. EFL students in Iran depend almost exclusively on classroom experiences to reconstruct their knowledge of complex grammatical structures, whereas English learners in an ESL context would be much more likely to naturalistically encounter simple and complex forms on a regular basis. Thus, recall and retention of the complex form may well be supported because of its natural exposure. The fact that cultuling and other components of the Brainling Model can be effective in this particular context of a diminished input environment suggests these further potential benefits offered by the Brainling Model will be more broadly applicable.

In sum, comparisons can be made concerning how previous studies proposed the Brainling Model as a promising approach to develop attitudes, motivation and processing of input, whilst this paper takes this argument a step further in that the Brainling Model is evidenced to also apply to learning the two cognitively complex learning area of grammar, especially in a context where exposure and practice was particularly unique.

The results can be justified based on Pishghadam et al.'s (2013) view that brainling components help learners memorize learning materials. Furthermore, according to Pishghadam and Tabataba'ian (2011), components of the Brainling Model enhance learning abilities. In this way, they turn learning into a persistent act for learners. What is more, these components generate stronger emotions in learners toward language learning which enhance their level of understanding that finally leads to enhanced recall and retention. Also, components of the Brainling Model enhance thinking skills and engagement of learners which in turn help them learn English language more easily. Besides, the Brainling Model components enhance learners' awareness of language structures via activating cognitive mechanism in them. This reduces difficulty of learning complex structures through attention, reasoning and problem-solving mechanisms. Enhancement of learners' control over language structures under the effect of the Brainling Model and their

autonomy can also be enumerated as mediating factors in the effect of the Brainling Model components on EFL learners' recall and retention of complex structures.

To interpret the higher effectiveness of cultuling in comparison to other components on EFL learners' recall and retention of complex structures, when cultural issues are incorporated in material development, learners' motivation and curiosity is stimulated. This encourages them to learn complex structures with higher willingness to learn. Accordingly, they learn complex structures more effectively. Moreover, it calls for different types of emotions which affect learners' world perceptions (Pishghadam et al., 2016). As a result, learners can create a vivid image of what they learn and learn complex structures with higher efficiency and quality. Additionally, cultural responses generate a stronger sense of belonging and proximity to content in EFL learners. This empowers them in learning complex structures.

What is more, the effectiveness of culturing component in fostering recall and retention can be better understood by considering insights from cultural psychology. Based on Markus and Kitayama's (1991) theory of culture and cognition, thought processes of individuals are distinctly formed by their cultural frameworks. In the context of a collecting culture (such as Iran), individuals tend to process and remember information better when they think about this information in contexts that are socially and culturally meaningful. The culturing component makes this cultural embeddedness relevant to learners' prior experiences, linking abstract grammatical structures to relevant cultural narratives, values, and practices. This situates the grammatical structures into broader cultural context, and they are able to personally associate their learning to these cultural contexts, contributing to the encoding of that information. In comparison, while other components of the Brainling Model may have provided cognitive scaffolding, culturing seemed to trigger the cognitive and affective pathways, allowing for deeper levels of processing. Involving learners' cultural identities and schemes meant that culturing was not simply a repetition strategy for recall, it was anchoring learning into personally and socially significant frameworks. This likely elucidates that, when conditions were equal, culturing was the most effective component of the Brainling Model to support long-term recall and retention.

Conclusion

It is concluded that the Brainling Model and its components significantly affect Iranian EFL learners' recall and retention of complex structures. Therefore, the Brainling Model along with its

components can be used at the service of enhancing recall and retention in EFL learners. Using the Brainling Model in EFL classes helps learners cope with the complexities of learning complex structures in short and long terms. Moreover, it is concluded that cultuling component of the Brainling Model can be used as a more effective component than other components in equal conditions to improve learners' recall and retention. Therefore, cultural elements are recommended to be injected into learning materials to help learners recall and retain complex structures.

The findings have several implications for EFL teachers, material developers and learners. Teachers can use the Brainling Model along with its components in general and cultuling in particular, in grammar classes to make recall and retention of complex structures less challenging for learners. Teachers are encouraged to embed Brainling components in their grammar instruction, especially culturing. For example, while teaching relative clauses, teachers might design activities that are grammar linked to cultural narratives such as short stories, traditions, or social practices in English speaking communities. Material developers can develop future EFL curricula based on the Brainling Model to reduce difficulties learners experience in recall and retention of complex structures. Curriculum designers should think about embedding cultural references and contexts into the grammar components of English language textbooks. The grammar exercises could focus on cultural comparisons. Textbook grammar could also include multimodal input (videos, songs, images, or proverbs) linked to cultural context that would provide some activation of the sensoling dimension and meet the EAL learner's cultural awareness. Additionally, reflection questions could be added at the end of the grammar lesson, to invite learners to link the target structures to their culture. Learners can take advantage of the Brainling Model and its components in practicing complex structures. They can benefit from using complex structures in meaningful and culture-connected ways. For example, they can write short essays using relative clauses to describe cultural events, films, or customs from their culture and from English-speaking cultures. This not only reinforces grammatical forms, but it also fosters cross-cultural competence, which deepens motivation and retention.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by ethics committee of Islamic Azad University.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Abdolmanafi Rokni, S. J., & Seifi, A. (2014). Dialog journal writing and its effect on learners' speaking accuracy and Fluency. *Study in English Language Teaching, 2*(1), 28-37. http://doi.org/10.22158/selt.v2n1p28

Alrayah, H. (2018). The effectiveness of cooperative learning activities in enhancing EFL learners' fluency. *English Language Teaching, 11*(4), 21-31. https://doi.org/10.5539/elt.v11n4p21

Anderson, J. R., Fincham, J. M., & Douglass, S. (1999). Practice and retention: A unifying analysis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25*(5), 1120–1136. https://doi.org/10.1037/0278-7393.25.5.1120

Aratemur-Çimen, C., & Bayhan, S. (2019). *Secularism and gender in Turkey's new textbooks II.* https://turkiye.fnst.org/content/degisen-ders-kitaplarinda-sekulerizm-ve-toplumsal-cinsiyet-esitligi

Ary, D., Jacobs, L. C., & Sorensen, Ch. (2010). *Introduction to research in Education* (8th ed.). Wadsworth Group.

Bagheri Masoudzade, A., & Fatehi Rad, N. (2022). Cognitive styles and sub-skills: A study on the relationship between reflectivity/ impulsivity dimension and vocabulary/ grammar development among EFL learners. *Curriculum Research, 2*(4), 1-10.

Bouzid, H. A. (2019). Gender issues in select Moroccan ELT textbooks. *Research in English Language Pedagogy, 7*(2), 209-231. http://doi.org/10.30486/relp.2019.665890

DeKeyser, R. M. (2005). What makes learning second-language grammar difficult? *A Review of Issues. Language Learning, 55*(S1), 1–25. https://doi.org/10.1111/j.0023-8333.2005.00294.x

Demirel, O. (2010). *Teaching to foreign language* (8th ed.). Pegem AkademiYayincilik.

Dewaele J. M., Chen X., Padilla A. M., Lake J. (2019). The flowering of positive psychology in foreign language teaching and acquisition research. *Front. Psychol. 10*, 2128. 10.3389/fpsyg.2019.02128.

Edwards, W. H. (2011). *Motor learning and control: From theory to practice*. Cengage Learning.

Ellis, R. (2008). Investigating grammatical difficulty in second language learning: Implications for second language acquisition research and language testing. *International Journal of Applied Linguistics, 18*(1), 4-22. https://doi.org/10.1111/j.1473-4192.2008.00184.x

Esmaili, F. (2011). *A comparative study on gender representation in Iranian high school English textbooks and American Headway series: A critical discourse analysis perspective* [Master's thesis, University of Arak]. ProQuest Dissertations and Theses Global.

Farhangi, B., & Pourmihammadi, M. (2018). The effect of intensive teaching of conditional sentences type one on Iranian grade three high school students' writing ability. *International Journal of English Language & Translation Studies, 6*(3), 99-105.

Ghorbani, M. R. (2009). English language teaching in Iran: A case of bifurcation. *Journal of Teaching English as a Foreign Language and Literature, 1*(2), 25–40.

Johansson, S. (2009). *Gender bias in EFL textbook dialogues.* Malmö högskola/Lärarutbildningen.

Khany, R., & Ghasemi, F. (2018). Development and validation of teacher emotional support scale: A structural equation modelling approach. *Journal of English Language Teaching and Learning, 10*(21), 137-160.

Khavatan, P., Lotfi, A. R., & Hadiyan, B. (2022). EFL Learners' Production of Relative Clause Structure: Evidence from Priming Effect. *Language and Translation*, *12*(1), 75-91. 10.30495/ttlt.2022.688335

Kintsch, W. (1970). Models for free recall and recognition. In D. A. Norman (Ed.), *Models of human memory* (pp. 331-373). Academic Press.

Lau, W. S., & Shea, M. (2022). Empowering English learners in the classroom through culturally responsive social-emotional teaching practices. *Journal of Multilingual and Multicultural Development, 43*(1), 1–18. https://doi.org/10.1080/01434632.2022.2078337

MacIntyre, P. D., & Gregersen, T. (2012). Emotions that facilitate language learning: The positive-broadening power of the imagination. *Studies in Second Language Acquisition, 34*(2), 193-213.

MacLean, P. D. (1990). *The Triune Brain in Evolution: Role in Paleocerebral Functions*. Plenum Press.

Marefat, H., & Abdollahnejad, E. (2014). Acquisition of English relative clauses by adult Persian learners: Focus on presumptive pronouns. *Journal of Teaching Language Skills, 5*(4),19-40. https://doi.org/10.22099/JTLS.2014.1858

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*(2), 224-253.

Nazari, M., & Karimpour, S. (2022). The role of emotion labor in English language teacher identity construction: An activity theory perspective. *System, 107*(3), 1-13. https://doi.org/10.1016/j.system.2022.102811

Nazeri, M. S. (2010). *Gender positioning in ELT: Critical discourse analysis of a series of internationally and locally produced textbooks* [Unpublished master's thesis]. University of Kashan.

Paivandi, S. (2008). *Discrimination and intolerance in Iran's textbooks*. Freedom House.

Papi, M. (2010). The L2 motivational self-system, L2 anxiety, and motivated behavior: A structural equation modeling approach. *System, 38*(3), 467–479. https://doi.org/10.1016/j.system.2010.06.011

Pishghadam, R. (2015). *Emotioncy in language education: From exvolvement to involvement.* The 2nd Conference on Interdisciplinary Approaches on Language Teaching, Literature, and Translation Studies.

Pishghadam, R., & Ebrahimi, S. (2020). Introducing the "brainling" model and examining its role in effective communication: A moving beyond communicative competence. *Language and Translation Studies (LTS)*, *53*(3), 1-32. https://doi.org/10.22067/lts.v53i3.87911

Pishghadam, R., & Mirzaee, A. (2008). English language teaching in postmodern era. *TELL, 2*(7), 89-109.

Pishghadam, R., & Tabataba'ian, M. S. (2011). Emotional intelligence: Can it be a predictor of performance on different test formats? *International Journal of Linguistics, 3*(1), 1-21. http://doi.org/10.5296/ijl.v3i1.637

Pishghadam, R., Adamson, B., & Shayesteh, S. (2013). Emotion-based language instruction (EBLI) as a new perspective in bilingual education. *Multilingual Educatiom, 3*(1), 1–16. https://doi.org/10.1186/2191-5059-3-9

Pishghadam, R., Jajarmi, H., & Shayesteh, S. (2016). Conceptualizing sensory relativism in light of emotiocy: A movement beyond linguistic relativism. *International Journal of Society, Culture and Language*, *4*(2), 11-21. https://www.ijscl.net/issue_3114_3609.html

Rashidi, N., & Babaie, H. (2013). Elicitation, recast, and meta-linguistic feedback in form-focused exchanges: Effects of feedback modality on multimedia grammar Instruction. *Journal of Teaching Language Skills*, *31*(4), 25–51. https://doi.org/10.22099/jtls.2013.1132

Sadeghi, S., Maftoon, P., & Yazdanimoghadam, M. (2022). An investigation into textual input enhancement and output production in relation to the noticing of English relative clauses: The case of Iranian EFL learners. *Journal of Language Horizons*, *6*(1), 7-27. https://doi.org/10.22051/lghor.2021.32221.1334

Sanatipour, S., Shayesteh, S., Pishghadam, R., & Boustani, N. (2024). Designing and validating a Brainling Model: A case of high school and language school textbooks. *Iranian Journal of Applied Language Studies*, *16*(1), 1-20. https://doi.org/10.22111/ijals.2023.46765.2383

Shahsavari, S. (2014). Efficiency, feasibility and desirability of communicative language teaching: Iranian teachers' perspectives. *Journal of Language Teaching and Research, 5*(2), 434–441. https://doi.org/10.4304/jltr.5.2.434-441

Sobhani, K. B. (2021). Relative clauses in Farsi: A typological study. *Linguistische Berichte*, (265). Iss. 265: S. 61–81 10.46771/2366077500265_3

Stockdale, A. D. (2006). *Gender representation in an EFL textbook* [Unpublished master's thesis]. University of Birmingham.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257-285.

Tomasello, M. (1999). *The Human Adaptation for Culture*. (Paper arguing humans are biologically adapted for cultural learning and joint attention)

Zhang, Y. (2014). Teaching statistics with effective textbooks. *Journal of Public Administration Research and Theory, 24*(1), 246-253. https://doi.org/10.1093/jopart/mut047