Teaching German modal verbs through cognitive linguistics insights

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Abstract

This study examined the acquisition patterns of the prototypical and epistemic semantic meanings of German modals. It investigated whether different instructional approaches (cognitive instruction approach based on force dynamics and metaphoric extensions, traditional translation based instruction) have the potential to foster modal verbs acquisition, and which of the two approaches was more effective. Thirty-three, fourth semester learners of German as a foreign language were subjected to one of the experimental conditions. Findings were compared to a control condition, which did not receive any instruction. Learning gains were measured by means of a multiple choice meaning recognition test that assessed students' gains of receptive knowledge of the prototypical and epistemic senses of German modals. Results revealed that when students received cognitive instruction, they gained greater prototypical and epistemic semantic knowledge when compared to the students who received traditional translation based instruction or were part of the control condition. Most importantly, it was shown that the cognitive instruction approach had greater effect on meaning retention of modal verbs senses.

1. Introduction

German modal verbs (dürfen, können, mögen, müssen, sollen, wollen) are mostly classified as a semantic domain that represents the speakers' attitude toward the notions of ability, permission, obligation, necessity, certainty and possibility (Bojanova, 2010; Diewald, 1999; Doitchinov, 2007; Gallmann, Eisenberg, Fiehler, Peters & Fabricius-Hansen, 2009; Hall & Scheiner, 1997; Helbig & Buscha, 1986). In spite of the fact that German modal verbs are some of the most common lexical items appearing in natural discourse, learners of German as a foreign language consider the semantic aspect extremely difficult to master (Fullerton, 1977). The difficulty might be caused by the polysemous nature of German modal verbs, and the fact that the semantics of their individual senses is not always clear to the learner. Typically, German modals exemplify one prototypical and several epistemic senses. While the prototypical sense illustrates the basic meaning of the modal, the epistemic senses are extended from the prototypical. Accordingly, the prototypical sense reflects the external, socio-physical world and expresses ability, obligation, and permission. The epistemic senses, however, reflect the speakers' internal, emotional and psychological world and convey logical conclusion, assumption or prediction (Bojanova, 2010; Diewald, 1999; Gallmann et al., 2009; Hall & Scheiner, 1997; Helbig & Buscha, 1986).

Even though existence of polysemy is not challenging for native speakers, it presents a high level of difficulty to second language learners (Kovacs, 2011). Yet, students have to master the semantics of German modals in order to achieve advanced levels of proficiency. To date, theoretical and applied linguists have mainly focused on defining, describing and categorizing the various senses of German modal verbs (Bojanova, 2010; Diewald, 1999; Gallmann et al., 2009; Hall & Scheiner, 1997; Helbig & Buscha, 1986; Rufer, 2010). Consequently, there is a lack of research aiming to delineate effective techniques for teaching the semantic aspect. In order to fill a gap in the current second language teaching literature, the present study explored how teaching and learning the semantics of German modals could be further enhanced. It was investigated whether different instructional approaches (traditional translation based instruction and cognitive instruction based on force dynamics and metaphoric extensions) have the potential to foster the acquisition of modal verbs semantics, and which of the two approaches was more effective. The results suggested that the two different instructional approaches vary in their effectiveness towards helping students learn the various senses of German modal verbs.

2. Background

2.1. Traditional teaching approaches

Traditional approaches to teaching the semantics of lexical items include activities such as matching words to their dictionary definitions, providing L1 equivalents, or using context clues to infer meaning (Allan, 2010; Bell & Leblank; 2000; Hulstijn, Hollander & Greidanus 1996; Knight, 1994; Nassaji, 2003; Nesi & Boonmoh, 2009; Wesche & Paribakht; 2000). Research indicates that these teaching methods often fail at providing experiences beyond memorization and thus, do not help learners make meaningful connections to concepts (Nakahara, 2005; Berendi & Csabi & Kövecses, 2008; Tyler & Mueller &Vu Ho, 2010; Verspoor & Lowie, 2003). In spite of that, a large number of German language textbooks used in North America (among them are Denk Mal; Wie geht's?; Treffpunkt Deutsch; Deutsch heute; Neue Horizonte; Kontakte; Vorsprung) rely on L1 translations to present the semantics of German modal verbs.

As a result, language learners are not provided with a comprehensive explanation of the systematicity existing between the different (prototypical and epistemic) senses of German modal verbs. Therefore, the strategy utilized by language textbook authors may not be sufficient for precise acquisition of modal verbs semantics.

2.2. Cognitive linguistics teaching approach

Cognitive linguists support the notion that polysemy is a conceptual phenomenon whereby lexical items comprise categories of distinct but related senses (Brugman, 1981; Brugman & Lakoff, 1988; Lakoff, 1987; Lakoff, 1993; Lakoff & Johnson, 1980; Taylor, 2003). In view of that, Sweetser (1990) demonstrated that English modal verbs represent a conceptual category in which "prototypical modal meanings are extended to the epistemic domain precisely because we generally use the language of the external world to apply to the internal mental world, which is metaphorically structured as parallel to that external world. Thus, we view our reasoning processes as being subject to compulsions, obligations, and other modalities, just as our real world actions are subject to modalities of the same sort" (p. 50). Sweetser's analysis of English modal verbs was based on Talmy's (1988) idea to explain the semantics of modality in terms of force dynamics. Talmy defined force dynamics as a category that describes "how entities interact with respect to force. Included here is the exertion of force, resistance to such a force, the overcoming of such a resistance, blockage of the expression of force, removal of such blockage, and the like" (p. 49). Adopting Talmy's basic idea of understanding prototypical modality in terms of forces and barriers, Sweetser offered a force-dynamic analysis of English modal verbs and proved that it could be extended from the prototypical to the epistemic domain. These findings challenged the work of earlier researchers, who assumed that lexical items are organized as an arbitrary list of distinct words that have the same form but different meanings. By contrast, the cognitive linguistics approach to teaching polysemous words has the potential to provide insights into the motivation for the prototypical and many extended epistemic uses of modal verbs. The advantages of the cognitive instruction approach to teaching modal verbs semantics became evident in two recent experimental studies (Abbuhl, 2005; Tyler et al., 2010).

A focal point in Abbuhl's study was the examination of the correct semantic usage of English modal verbs. She compared two writing samples of thirty-eight groups of international students enrolled at a university level writing class. Participants were divided in two groups: cognitive group and control group. Both groups received feedback on the first draft. However, the difference exists in the type of feedback they received. While the cognitive group received feedback on content and form, the control group received feedback on content only. A week after the first draft was completed; the cognitive group received a thirty-minute, teacher-fronted instruction on the semantics of the English modals. The teacher-fronted instruction was followed by a pair work activity. Students were asked to analyze and discuss the use of the given modals. The findings suggested that the final drafts of the students in the two groups differed significantly from one another. While the control group showed no improvement in the use of English modals, the cognitive group improved significantly.

Although the study conducted by Abbuhl lent support to the cognitive instructional method when teaching the semantics of modal verbs, there was a major limitation that needed to be addressed. A certain drawback was the fact that there was no group who received a traditional teaching instruction. Hence, Abbuhl's study does not provide information whether the cognitive approach

was more effective than a traditional approach such as guessing meaning from the context, demonstrating meanings of modal verbs via speech acts or providing L1 equivalents. This limitation was addressed in a more recent study carried out by Tyler et al. (2010).

Tyler et al. conducted a comparative study of two different approaches to teaching English modal verbs. The researchers aimed at presenting experimental evidence that a cognitive linguistics based approach is more effective than a traditional speech act approach. Sixty-four international students studying at a large US university were enrolled in this study.

The cognitive treatment consisted of a teacher-fronted explanation of the force dynamic interpretation of the prototypical and epistemic senses of English modals. The students received a sheet of paper with diagrams visualizing the force dynamics associated with each modal verb. Students were encouraged to take part in the discussion by asking questions and giving examples. After the teacher-fronted discussion, students engaged in interactive follow-up activities, which aimed at practicing the usage of modal verbs in appropriate contexts.

The students who were exposed to the traditional treatment received a list with English modal verbs and explanation of their speech act functions. The researcher led a discussion over speech act functions and the respective modals used to express those functions. These speech act functions included: expressing physical ability; seeking and granting permission, making a request, giving advice, giving a suggestion, stating a preference, expressing necessity, obligation or future possibility, and making assumptions. Students were encouraged to read the example sentences aloud and define the function expressed by the given modal verb. The group discussion was followed by interactive tasks through which students were encouraged to identify the various functions of modal verbs and use them in context.

The test instrument used in this experiment assessed students' use of the various senses of the targeted English modals. Both groups, the cognitive and the traditional, took the pretest the day before the treatment. The posttest was administered immediately after the treatment. The tests consisted of forced choice fill-in-the-blank items. Students were asked to choose the most appropriate modal from four possible choices. The tests were constructed in a way that only one modal verb was appropriate for a given paragraph.

Results showed that while the cognitive group demonstrated significant gains in the correct use of modal verbs, the speech act group demonstrated no gain of knowledge. By and large, the results from this experiment supported the hypothesis that enhancing learners' awareness of the motivations behind the prototypical and epistemic senses of a lexical item helps learners to remember polysemous word senses better than in the case where learners are exposed to traditional methods of instruction. Nevertheless, there are some shortcomings that must be discussed. First, the effect of the cognitive approach to teaching modal verbs should be tested within other languages. Second, the current results are generalizable only to advanced language learners. Research should address the effect of the cognitive approach on teaching modal verbs to students at varying levels of proficiency. Last but not least, a significant caveat is the fact that there was no delayed posttest. It should be examined whether the participants in the cognitive instruction group retained the knowledge gained as a result of the treatment. Knowing the answers to these questions would allow language instructors to make informed pedagogical decisions and thus, rely on the most effective approach when teaching polysemous lexical items.

3. The present study

3.1. Research questions

- Does integrating a cognitive instruction approach to the teaching and learning of the various senses of German modal verbs yield superior results when compared to a traditional instruction method and a control condition?

- Are the retention scores for the cognitive instruction group better when compared to the traditional instruction group and the control group?

- Are the immediate gains of semantic knowledge retained over time?

3.2. Methods

3.2.1. Participants

Thirty-three undergraduate students enrolled in a forth semester German as a foreign language classes at a large US university voluntarily participated in the present study. All of the participants were native speakers of English who have never visited a German speaking country and had no German instruction outside of the university classes. Participants came from three different classrooms allowing for a convenience sampling to be employed. The intact classes were randomly assigned to a cognitive instruction treatment (N=12), a traditional instruction treatment (N=11), or a control condition (N=10). Initially, forty-eight students were recruited for the study. Fifteen participants were eliminated from the experiment for not attending all teaching or testing sessions, leaving only thirty-three participants for analysis.

3.2.2. Choice of target modal verbs

Müssen, sollen, mögen, and wollen were considered for the present study. Nevertheless, these verbs cannot be treated as a homogeneous category. While some modals have the same prototypical and epistemic semantic meanings and functions as their English counterparts (müssen/ must), others have overlapping prototypical but distinct epistemic senses (sollen/ should, wollen/ to want, mögen/ to like) (Table 1). Existing research evidence suggests that in most cases the target language semantic system differs from the semantic system of the native language (Littlemore & MacArthur, 2007; Walker, 2008). Therefore, by learning a new language, students need to conceptualize the senses of lexical items in ways different than they used to in their native language. However, the majority of the current German language textbooks fail to present the fact that German modals are highly polysemous and that their semantic functions often differ from the semantic functions of their L1 equivalents.

Table 1

**Semantic meanings of German modals and their English equivalents**

German modals	English modals
Prototypical senses	
Sie **muss** einen Brief schreiben. (Obligation on account of foreign will)	She **mus**t write a letter. (Obligation on account of foreign will)
Wir **sollen** die Hausaufgaben machen. (Obligation on account of own will)	We **should** do our homework. (Obligation on account of own will)
Er **will** einen Brief schreiben. (Intention, Desire)	He **wants** to write a letter. (Desire)
Ich **mag** Schokolade. (Desire, Wish, Preference)	I **like** chocolate. (Desire, Wish, Preference)
Epistemic senses	
Sie **müsste** eigentlich informiert sein. (Assumption)	She **must** have been informed. (Assumption)
Er **soll** kriminell gewesen sein. (Assertion)	You **should** study harder. (Advice) He **should** be here soon. (Probability) I **should** think they will come soon. (Opinion)
Er **will** davon nichts gewusst haben. (Assertion)	I **want** you to do your homework. (Request) The customers **want** the new product to be high quality. (Demand)
Der Verbrecher **mag** die Wahrheit sagen, aber der Richter glaubt ihm nicht. (Possibility)	*The verb **to like** bears no extended meanings.*

3.2.3. Teacher-fronted cognitive instruction

The cognitive instruction was designed according to the idea of Abbuhl and Tyler et al. of presenting modal verbs semantics in terms of metaphorical extensions from the prototypical sense to the epistemic senses. Accordingly, the various senses were presented with respect to force as discussed within the force-dynamic domain (Sweetser, 1990). The prototypical and

epistemic senses of German modals were presented by means of diagrams, which demonstrated the force dynamics associated with the various senses of each modal. The diagrams were adopted from Abbuhl and Tyler et al. However, the diagrams utilized in the present study reflect the semantics of German modal verbs (Appendix B). The meaning of the symbols used for the diagrams are presented in Appendix A.

Students were first introduced to the force-dynamic principles underlying the semantics of the prototypical senses (Appendix B). Note the diagram representing the semantic meaning of *müssen* (must).
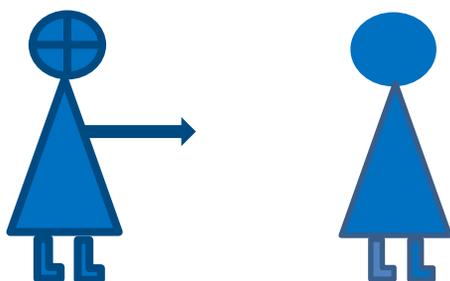
The diagram shows two figures. The image on the left side stands for the authority figure who applies direct and irresistible force to the figure on the right. The arrow ⟶ used in the image on the left side stands for obligation on account of a foreign will. It shows directly applied and

irresistible external force. The circle ⊕ representing the head of the figure on the left stands

for the figure's ability to make own decisions. The empty circle ◯ representing the head of the image on the right as well as the lack of a thin arrow ⤍. stands for lack of own decision or lack of free will (Appendix B). In sum, the image shows that *müssen* denotes obligation, which is extrinsically imposed by an authority figure. The theoretical explanation is further supported with an example sentence demonstrating the prototypical use of the modal:

> Um 21 Uhr ist es schon dunkel. Die Kinder von Maria **müssen** immer spätestens um 21 Uhr zu Hause sein. (*It is already dark at 9pm. Maria's children must be home before 9pm.*)

The example sentence is followed by a discussion explaining the roles of the agents in the given situation. In this case, Maria is the external authority, who obliges her children to be home before 9 pm. Thus, the force applied by the authority figure (Maria) is irresistible and therefore her children must obey her will.

The epistemic senses were presented second (Appendix B). It was explained to students that humans perceive the epistemic senses as their socio-physical understanding of force and mapping of that understanding onto the domain of reasoning. In like manner, the metaphorical mapping between prototypical and epistemic senses of German modals was situated. For that purpose, the already discussed forces and barriers were recast as premises in the internal psychological world of the speaker. Students were told that while the socio-physical modalities represent external or internal forces, the epistemic modalities could be imposed only by the

existing premises, which count as barriers or forces (Sweetser, 1990). The result that arises from the interaction with these premises is the speaker's logical conclusion or the assumption that was made. Note the following epistemic example sentence:

>Sabine ist nicht zur Schule gekommen. Sie **muss** krank sein. (*Sabine did not go to school. She must be sick.*)

The example sentence is followed by an explanation stating that the existing evidence is so strong (Sabine did not come to school. This is highly unusual behavior for her. She always comes to school unless she is sick.) that the speaker is forced to conclude Sabine is sick.

3.2.4. Cognitive instruction learning task

The cognitive instruction learning task was adopted from Abbuhl (2005). Students were given eight sentences containing the targeted modal verbs. The sentences were presented in two sets, each set dealing with only two of the modals. Two of the sentences in each set were dealing with the prototypical senses and two sentences were dealing with the epistemic senses. The sentences in each set were created in a way that allows for both target modals to be used. Students' task was to determine the appropriate semantic use of each modal and discuss how the choice of müssen vs. sollen or mögen vs. wollen could affect the interpretation of the sentences. Students were asked to discuss the meanings of the modals in terms of force dynamics and decide how the different forces affect the semantics of the given sentences (Appendix C).

3.2.5. Teacher-fronted traditional instruction

The traditional instruction treatment was developed according to the activities found in most German language textbooks used in North America. Among them are *Denk Mal; Wie geht's?; Treffpunkt Deutsch;. Deutsch heute; Neue Horizonte; Kontakte; and Vorsprung*. By and large, textbook authors introduce the modal verbs senses through L1 equivalents. Accordingly, in the present study, the prototypical and epistemic senses of the modals were presented alongside their English equivalents (Appendix D). In addition, the contextual usage of individual senses was demonstrated through example sentences. The students who were part of the traditional instruction group received the same example sentences as the students in the cognitive instruction group. In this way, the researcher controlled for any undesired influence of potential intervening variables (such as difference in the vocabulary used for the sentences; or any grammatical structures that might cause difficulties to the participants in the study) on the variable under investigation. By eliminating the effect of confounding variables, the researcher concluded that the difference in the obtained scores was a result of the treatment alone.

3.2.6. Traditional instruction learning task

This learning task was designed to encourage students to consider the differences in the multiple senses of German modals by employing their L1 equivalents. Hence, the learning task for the traditional instruction group focused on providing the appropriate English equivalents for the targeted senses of the German modals. Students were asked to take the context of the sentences into consideration and provide the most appropriate English equivalent for the given context. The same eight sentences used for the cognitive instruction learning task were utilized (Appendix E). Students were asked to provide the L1 equivalents for the prototypical senses first and then for

the epistemic. By progressing in this order, the students in the traditional group followed the same order of engaging with the targeted modals as the students in the cognitive group.

3.2.7. Control group

The control group received no treatment. However, the students completed the pretest, immediate posttest, and delayed posttest. This procedure was carried out to ensure that no learning occurred as a result of taking the tests alone.

3.2.8. Procedures

Three intact fourth semester German language classes at a large US university were randomly assigned to the cognitive treatment, traditional treatment or control condition. The pretest was administered to all study participants a week before the treatment. Instructional treatments took place a week after the pretest and were administered by the researcher. The instructional treatment consisted of a forty-minute teacher-fronted instruction phase on the prototypical and epistemic senses of German modal verbs. After the teacher-fronted instruction, the students in both treatment groups engaged in interactive activities that emphasized the different semantic aspects of the targeted German modals. Students were asked to work in pairs and discuss the various senses of the targeted modals according to the instructional method they were subjected to. The students who were part of the control group did not engage in any learning activities. After the treatment and follow-up phases, the participants in all three groups took an immediate posttest aiming to test their ability to comprehend the senses of German modal verbs. In order to assess knowledge retention, the participants in all three groups took an unannounced delayed posttest a week after the treatment.

3.2.9. Assessment

Receptive learning gains were measured by means of a pretest, an immediate posttest, and a delayed posttest. The pretest determined the level of students' knowledge of the senses of German modals before the experiment. The immediate posttest showed whether the instructional treatment had any effect, e.g. whether students have acquired the various senses as a result of the treatment. The delayed posttest evaluated the retention of the semantic meanings and was used as evidence for long-term knowledge gain.

Each test consisted of thirty test items. There were three prototypical and three epistemic test items for each of the four modal verbs. In addition, there were six distractor sentences among the twenty four testing items. Each test item consisted of a sentence that covers the prototypical or epistemic sense of a certain modal verb and six multiple choice items (Table 2). The multiple choice items represent possible context for the targeted modal verb. The test items were created in a way that only one answer was possible. A *do not know* response was added to the multiple choice items to avoid random guesses. Three versions of the test were created. The test items in each version were the same; however, they were presented in mixed order. Students received a different version for the pretest, immediate posttest, and delayed posttest. In order to complete the test assignment, students were asked to choose the answer that best describes the meaning of the targeted modal verb in the given sentence.

Table 2
Sample test items

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1. Die Kandidaten <u>müssen</u> am Prüfungstag einen Ausweis zeigen.
   a) It is possible
   b) It is mandatory
   c) It is recommended
   d) It is planned
   e) No answer
   f) Do not know

2. Sie <u>müssen</u> sich irren.
   a) It is possible
   b) It is certain
   c) It is recommended
   d) It is planned
   e) No answer
   f) Do not know

Note.   1. Example for prototypical, 2. Example for epistemic.

3.2.10. Statistical analysis

To find out whether the cognitive instruction group outperformed the traditional instruction and control groups, by taking into consideration the effect of prior knowledge, the scores were submitted to a 3 x 3 Omnibus ANOVA. Time was the within subject factor. Treatment condition was the between subject factor. Each of the two independent variables, treatment condition (cognitive instruction, traditional instruction, control) and time (pretest, immediate posttest, delayed posttest) had three levels. The dependent variable represented the receptive meaning scores of modal verbs. Levene's test indicated that the assumption of homogeneity of variance has been met ($p > .05$). All effects are reported as significant at $p < .05$.

In order to answer research questions one and two, test scores were submitted to a One Way ANOVA between-subject test. Levene's test of equality of variance showed that the assumption of homogeneity of variance was met for each of the analyses ($p > .05$). A Bonferroni post-hoc test was employed for subsequent comparisons. Results were reported as significant at $p < .05$.

In order to investigate research question three, scores were submitted to a Repeated Measures ANOVA with time as the within-subject factor. Mauchly's test showed that the assumption of sphericity was met for each of the analyses ($p > .05$). Subsequent pairwise comparisons were employed to determine how the groups (cognitive, traditional, control) differed from one another. Results were reported as significant at $p < .05$.

3.2.11. Scoring

The correct interpretation of the semantic meanings was scored for accuracy. Each correct answer received a score of 1 and each incorrect, blank, or *do not know* response received a score of 0.

3.2.12. Comparability of study participants

The study participants in all three groups possessed similar semantic knowledge at the time of the pretest. Results from the One Way ANOVA revealed that there was no significant difference between the mean scores of the cognitive instruction, traditional instruction and control groups, $F(2, 30)=3.096$, $p=.06$, $\eta^2 =.17$ (Table 3).

Table 3
Means for instruction type by testing time

	Treatment Type	n	M	SD	Min	Max
Pre-test	CI	12	13.42	2.94	9	19
	TI	11	12.09	2.34	8	15
	C	10	12.00	2.53	8	16
Immediate	CI	12	19.75	1.35	18	23
Post-test	TI	11	15.55	2.58	11	20
	C	10	10.90	2.23	6	14
Delayed	CI	12	18.33	2.53	14	23
Post-test	TI	11	13.27	3.77	7	19
	C	10	10.70	1.89	6	13

Notes. CI   Cognitive instruction
     TI   Traditional instruction
     C   Control

4. Results

Results from the 3 x 3 Omnibus ANOVA revealed a significant main effect for treatment type, $F(2,30)=30.3$, $p=.00$, $\eta^2 =.67$ and a significant main effect for time, $F(2, 30)=15,414$, $p=.00$, $\eta^2 =.52$. The main effect for treatment type and the main effect for time, however, were qualified by a significant treatment type by time interaction, $F(2, 30)= 6.519$, $p=.00$, $\eta^2 =.31$.

4.1. Research question 1: *Does integrating a cognitive linguistics inspired approach to the teaching and learning of the various senses of German modal verbs yield superior results when compared to a traditional teaching method and a control condition?*

Results from the One Way ANOVA revealed that, immediately after the treatment, there was a significant difference in the receptive scores between the cognitive instruction, traditional instruction, and control groups, $F(2,30)=48.620$, $p=.00$, $\eta^2 =.76$. The follow-up Bonferroni comparisons indicated that immediately after the treatment, the students who learned the semantic meanings through cognitive insights gained significantly higher receptive knowledge than the students who received traditional translation based instruction, or no instruction. Moreover, the students who received the traditional translation based instruction possessed significantly higher receptive knowledge when compared to the students who were part of the control group (Table 4).

Table 4
Post-hoc tests for receptive scores on the immediate posttest and delayed posttest

Time of test	Post-hoc tests for receptive scores				
	Pairwise comparison	Mean difference	95% Confidence	Sig.	Cohen's d (effect size)
Immediate	CI-TI	4.205*	[1.99, 6.42]	.00	2.14
Posttest	CI-C	8.850*	[6.57, 11.13]	.00	4.79
(Bonferroni)	TI-C	4.645*	[2.32, 6.97]	.00	1.93
Delayed	CI-TI	5.061*	[2.04, 8.09]	.00	1.57
Posttest	CI-C	7.633*	[4.53, 10.74]	.00	3.41
(Bonferroni)	TI-C	2.573	[-0.59, 5.74]	.14	0.84

Note. CI-Cognitive instruction, TI-Traditional instruction, C-Control.
    *The mean difference is significant at the 0.05 level.

4.2. Research question 2: *Are the retention scores for the cognitive instruction group better when compared to the traditional instruction group and the control group?*

Results from the One Way ANOVA revealed that, one week after the treatment, there was a significant difference between the three groups, $F(2,30)=20.599$, $p=.00$, $\eta^2 = .58$. The follow-up Bonferroni comparisons revealed that the mean receptive scores of the students who received cognitive treatment were significantly higher than the mean scores of the students who were part of the traditional instruction group or received no instruction. By contrast, there was no significant difference between the mean scores of the students who received traditional instruction and the students who were part of the control group (Table 4).

4.3. Research question 3: *Are the immediate gains of semantic knowledge retained over time?*

4.3.1. Cognitive instruction group

Results from the Repeated Measures ANOVA revealed that there was a significant difference in the receptive scores between the pretest, immediate posttest and delayed posttest for the students who received cognitive instruction, $F(1,11)=22.087$, $p=.00$, $\eta^2=.82$. These results were followed up with pairwise comparisons. The first comparison, revealed a significant difference between the scores in the pretest and immediate posttest, indicating that students recognized significantly more modal verb senses immediately after the treatment when compared to the pretest. The second comparison revealed a significant difference between the receptive scores of the pretest and delayed posttest, indicating that students recognized significantly more senses in the delayed posttest when compared to the pretest. The third comparison indicated no significant difference between the receptive scores in the immediate posttest and delayed posttest, suggesting that the students who received cognitive instruction retained the knowledge gained as a result of the treatment (Table 5).

Table 5
Post-hoc tests for receptive scores retention

Group	Post-hoc tests for receptive scores retention				
	Pairwise comparisons	Mean difference	95% Confidence	Sig.	Cohen's d (effect size)
CI	PT-IPT	-5.333*	[-7.87, -2.80]	.00	2.33
	PT-DPT	-3.917*	[-7.57, -0.27]	.03	1.43
	IPT-DPT	1.417	[-0.62, 3.45]	.23	0.70
TI	PT-IPT	-3.455*	[-5.29, -1.62]	.00	1.40
	PT-DPT	-1.182	[-3.43, 1.07]	.49	0.37
	IPT-DPT	2.573	[-0.05, 4.59]	.05	0.70

Note. CI-Cognitive instruction, TI-Traditional instruction, PT-Pretest, IPT-Immediate posttest, DPT-Delayed posttest.
    *The mean difference is significant at the 0.05 level.

4.3.2. Traditional instruction group

Results from the repeated measures ANOVA indicated a significant difference in the receptive scores between the pretest, immediate posttest and delayed posttest for the students who received traditional instruction, $F(1,10)=13.323$, $p=.00$, $\eta^2=.75$.

The post hoc pairwise comparisons revealed a significant difference between the scores in the pretest and immediate posttest with higher mean scores in the test immediately following the treatment. The comparison between the immediate posttest and delayed posttest indicated that the mean score decreased one week after the treatment and the mean difference approached significance. By contrast, there was no significant difference between the scores in the pretest and delayed posttest, indicating that the students in the traditional instruction group did not retain the knowledge gained as a result of the treatment (Table 5).

4.3.3. Control group

Results from the repeated measures ANOVA indicated that there were no significant differences in the receptive scores between the pretest, immediate posttest and delayed posttest for the students who received no instruction, $F(1,9)=1.607$, $p=.26$, $\eta^2=.29$. This finding suggested that the study participants did not gain any receptive semantic knowledge as a result of taking the three tests (Table 3).

5. Discussion

The current study aimed to provide insights of how cognitive linguistics underpinnings could be applied to the development of instructional materials when teaching the various senses of German modal verbs. In particular, it investigated whether there was a difference in the amount of receptive knowledge gained and retained between the cognitive instruction, traditional instruction and control groups.

5.1. Differences based on treatment condition

The first research question investigated whether a cognitive linguistics inspired approach to the teaching and learning of German modal verbs senses yields superior results when compared to a traditional teaching method and a control condition. The answer to this research question might have the potential to empower language instructors to make informed pedagogical decisions, and thus, rely on the most effective pedagogical approach when teaching modal verbs semantics.

Results showed that, immediately after the treatment, the students who engaged in exploring modal verbs semantics through force dynamics and metaphoric extensions or through L1 equivalents gained more receptive knowledge of the target senses than the students who received no instruction. Most importantly, the students who learned the semantic meanings of German modal verbs by means of cognitive linguistics insights showed significantly more receptive knowledge when compared to the students who learned the various senses through L1 translations (Table 4).

These findings appear to be consistent with the results from previous L2 studies on acquisition of polysemous lexical items (Berendi et al., 2008; Tyler et al., 2010; Verspoor & Lowie, 2003), suggesting that those second language learners who were exposed to the metaphoric meaning extensions of polysemous words comprehend and remember the various senses better than the learners who were not exposed to such knowledge. Furthermore, the findings from the current study extended previous observations on teaching modal verb semantic meanings. While, Abbuhl (2011) explored whether there is a difference in the amount of modal verb semantic

knowledge gained through force dynamics and metaphoric extensions when compared to a no instructional treatment; and Tyler et al. (2011) explored whether there is a difference in the amount of modal verb semantic knowledge gained through force dynamics and metaphoric extensions when compared to the teaching of speech acts, the current experiment investigated whether there was a difference in the amount of receptive knowledge of German modal verbs semantic meanings gained between three different conditions. It should be noted that while the students subjected to the traditional instruction group in Tyler et al. (2011) study learned modal verbs semantic meanings through speech acts, the students who were subjected to the traditional instruction group in the present study learned modal verbs senses through L1 translations. Hence, the current study not only showed that learners who acquired modal verbs semantic meanings through cognitive linguistics insights tend to gain more semantic knowledge when compared to traditional teaching approaches or no instruction, but also demonstrated that teaching German modal verbs semantic meanings through L1 translations resulted in more receptive semantic knowledge when compared to the no instruction condition (Table 4).

The present study differed from the previous studies on modal verbs teaching and learning in the way the target lexical items were tested. While Abbuhl and Tyler et al. looked at students' productive knowledge gains, the present experiment examined students' receptive knowledge. Since the teaching time was limited to 40 minutes only, the researcher considered that using the target verbs productively would have been extremely difficult for the students. This difficulty might have been caused by the fact that for productive purposes the word knowledge has to be more precise (including knowing the concept behind the word, using the word in different contexts to express various senses etc.) and it would take more time and effort to acquire this type of knowledge (Nation, 2001).

5.2. Long-term retention

While the existing research on acquisition of modal verbs semantics focused primarily on the short-term effect of the different treatment conditions and utilized an immediate posttest to determine whether the different treatment conditions were effective, the present study was the first one to look at long-term learning. The reason for incorporating a delayed posttest into the study format is related with the fact that although the information obtained from the immediate posttest could be useful (reveals whether the treatment type has an initial effect on students' learning), it is accompanied by a major limitation. Hence, it is widely accepted that limited exposure to the target lexical items is not likely to lead to long-term knowledge gain (Schmitt, 2010). Accordingly, the scores obtained from the immediate posttest cannot be interpreted as long-lasting learning. In order to depict the long-term learning of modal verbs semantics, it was essential to utilize a delayed posttest, which serves as an indication of durable learning.

In view of that, research question two explored whether the retention scores for the cognitive instruction group were better when compared to the traditional instruction group and the control group. Results revealed that, one week after the treatment, the students who learned the prototypical and epistemic meanings through cognitive instruction possessed higher receptive knowledge than the students who were part of the traditional treatment group or the control group. Moreover, there was no significant difference between the receptive knowledge scores for the traditional instruction group and the control group, which indicated that the receptive semantic knowledge gained through L1 translations did not last a week after the treatment. In

addition, research question three measured whether the immediate gains of semantic knowledge for each of the three different groups was retained a week later. Results demonstrated that both the cognitive instruction group and the traditional instruction group gained semantic knowledge as a result of the treatment. However, only the students who learned through force dynamics and metaphoric extensions retained the gained semantic knowledge a week later (Table 4).

Usually, retention of semantic knowledge is significantly better during the immediate posttest when compared to the delayed posttest; however, the present study demonstrated that when learning the semantics through force dynamics and metaphoric extensions, students tend to retain the knowledge gained as a result of the treatment. Although, the cognitive instruction proved to be more effective in learning and retaining the prototypical and epistemic senses of German modals, the author does not claim that this teaching approach represents an effortless way of mastering the various senses of German modals. By taking into account the amount of mental work involved in understanding the connection between the prototypical and epistemic senses, and also the level of abstractness of the definitions associated with each semantic nuance, it is possible that the better results under the cognitive instruction condition are attributable to the greater amount of cognitive effort invested by the students. Thus, the findings are in accord with the Levels-of-processing model developed by Craik and Lockhart (1972), who suggested that deeper semantic processing results in a more elaborate and longer lasting memory traces. Consequently, the present study coincides with previous research on vocabulary acquisition, which demonstrated that teaching methods that present higher amount of mental effort lead to greater gains in short- and long-term word retention (Hulstijn and Laufer, 2001;Keating, 2008; Laufer & Hulstijn, 2001; Rott, 2012).

Additionally, the cognitive instruction teaching materials utilized in the present study focused on directing students' attention towards the differences between the multiple semantic meanings of German modals. A common mistake made by language learners is operating the target language by relying on the semantic meanings of their L1. To avoid this mistake, language learners should be informed about the existing semantic differences between the target language and their L1, and thus, conceptualize the semantic meanings in a way native speakers do. However, very often, learners fail at completing this task. Holme (2009) claims that "central to how we conceptualize a language is the issue of what we should attend to when deciphering meaning" (p.113). Hence, learners who encounter the various semantic senses of German modals may not notice the subtle differences between them, and therefore, may not conceptualize them in the way native speakers do. As a result, "non-native speakers tend to avoid using metaphorical senses of words, preferring to stick to more literal uses" (Littlemore, 2009, p. 48). Littlemore provides a possible explanation for learners' behavior by claiming that "metaphorical meaning may not be salient to them" (p. 94). The cognitive instruction teaching materials utilized in the present study have the potential to take the L2 learners closer to the way German native speakers operate the multiple meanings of a lexical item. Consequently, the cognitive instruction teaching materials have the capacity to make the different semantic meanings of German modals salient to language learners. This is achieved by using picture diagrams that depict the relations of power and exertion of force between the participants in a given scene and by providing learners with multiple example sentences that illustrate the usage of the various semantic meanings of German modals. Research has demonstrated that relying on picture diagrams when trying to understand the semantic meanings of a lexical item is central to learners' conceptualization, in part because, it provides the learners with a chance to foreground a scene and thus make it a focus of attention (Talmy,

1988). The picture diagrams in the present study were created in a way that helped students notice the targeted semantic meaning and develop their awareness of the existing semantic differences. Consequently, the picture diagrams were the tool that gave learners the target meaning they needed to conceptualize. Furthermore, the example sentences contextualized the multiple semantic meanings of German modals by demonstrating how they are used by native speakers. In general, cognitive instruction teaching approaches are viewed as a powerful way to clarify semantic meaning. The cognitive instruction teaching approach utilized in the present study drew learners' attention to the target semantic meanings and ensured subsequent noticing and awareness raising, which are crucial for the acquisition of polysemous lexical items.

Nevertheless, the results from the present study should be interpreted carefully. The test format is more compatible with the cognitive instruction method than with the traditional translation method, because it requires students to match the different senses with definitions, not L1 equivalents. Hence, the students in the cognitive group might have felt more comfortable completing the assessment task than the students in the translation group. Consequently, the study results might have been influenced to some extent by the test format, and therefore, they should be interpreted with caution.

5.3. Teaching implications

The present study refined our understanding of which instructional method (CI, TI) is more effective when teaching the semantic meanings of German modal verbs. The results of the statistical analysis demonstrated that the cognitive instruction group experienced significant gains over the traditional instruction group. The difference in the initially gained and retained semantic knowledge, between the two groups (CI, TI), could be attributed to the treatment materials utilized in the present study. The materials presented to the traditional translation based group constituted of the English equivalents and contextualized examples aiming to guide students' understanding of the appropriate semantic use. Hence, students were familiar with this teaching method, and therefore, they were not inquired to learn a new system of thinking about the modal verbs. In contrast, the cognitive instruction approach offered many new concepts that needed to be acquired by the students. Students were expected to understand the semantic nuances of German modals in terms of force dynamics and contemplate the role of metaphor in structuring the semantic system. These notions denote fundamentally different ways of thinking about the semantic meanings. Additionally, students were expected to learn many new semantic nuances of the German modals and understand how these senses are used in meaningful contexts. All of these different aspects, associated with the cognitive instruction, presented a set of complex cognitive demands. Thus, it is quite possible that the better results associated with the cognitive instruction condition were a result of the greater amount of cognitive effort invested by the students. Hence, the deeper semantic processing resulted in more elaborate and longer lasting memory traces. In other words, the higher amount of mental effort led to greater gains in short- and long- term word retention.

Considering the fact that the traditional translation based teaching approach fails to provide clear explanation for the relationship between the prototypical and epistemic senses of German modal verbs and by taking into consideration the results of the present study, the author recommends that the semantic meanings of German modals are taught through force dynamics and metaphoric extensions. Teaching the various senses of German modal verbs through cognitive linguistics

insights might raise students' awareness of the fact that modal verbs are highly polysemous and that the different semantic nuances are utilized in various contexts. Acquiring this knowledge would help students become more effective readers and writers in the target language. In order to successfully employ the cognitive instruction approach to teaching the semantic meanings of German modal verbs, instructors need to develop their teaching materials carefully and present them in a structured manner. First of all, instructors need to provide detailed description of the meanings of the various symbols and pictorial representations utilized in the force dynamics explanation of modal verbs. Second, instructors need to carefully explain the principles underlying the metaphoric extensions (mapping the target domain onto the source domain). Next, it must be explained how certain conceptual metaphors structured the epistemic meanings of German modals. Last but not least, students need to receive contextualized input, which demonstrates how each of the modals functions in different contexts. The cognitive treatment materials, employed in the present study, could be used by language instructors as an example for materials development.

5.4. Limitations and future research

There are a number of limitations that apply to the current study. First of all, the participants were intermediate, adult learners of German as a foreign language. Future research should investigate the effectiveness of the cognitive instruction teaching method when learners are at lower or higher levels of proficiency. It would be interesting to find out whether the cognitive instruction approach would be less, equally, or more effective when presented to beginners or more advanced learners of German as a foreign language. The results from such future studies could refine our understanding of the effectiveness of the cognitive instruction method at various proficiency levels (beginner, intermediate, advanced) and help us understand at which stage of the language acquisition process the use of the cognitive instruction teaching strategy would be most effective.

Second, the experiment focused on the teaching of a limited set of German modals, müssen (must), sollen (should), wollen (to want), mögen (to like). Future investigation should address the full set of German modal verbs including können (can), möchten (would like), and dürfen (to be allowed), as well as the modal phrases such as in der Lage sein (to be able), imstande sein (to be able), fähig sein (to be able), Begabung haben (to have the talent), begabt sein (to be talented), die Gelegenheit haben (to have the opportunity), Chance haben (to have a chance), den Wunsch haben (to have the desire), gewillt sein (to be desired), die Absicht haben (to have the intention), einen Plan haben (to have a plan), die Aufgabe haben (to have the task), entschlossen sein (to be determined), gezwungen sein (being obliged), verpflichtet sein (being obliged), notwendig sein (it is necessary), den Auftrag haben (have the order), erforderlich (required), geboten (necessary), unumgänglich (absolutely necessary), erwartet sein (it is expected), gefordert (required), verlangt sein (required), die Aufgabe haben (to have the task), geplant sein (to be planned), auffordern (to request), empfehlen (to recommend), ratsam sein (advisable), empfehlenswert sein (advisable), einen Rat bekommen (to receive an advice), bereit sein (to be ready), Erlaubnis haben (to have permission), zulässig sein (it is permitted), verboten sein (prohibited), nicht erlaubt (not permitted), nicht gestattet (not allowed), geeignet sein (suitable), machbar sein (doable), etc. The modal phrases add additional layer to the complicated German modal system. Future investigation targeting the modal phrases would let us better understand how certain teaching methodology (CI, TI) impacts the initial learning and retention of semantic

nuances. Moreover, it could be investigated whether the cognitive instruction approach is equally effective when teaching modal phrases as it proved to be with modal verbs.

Third, the testing methodology of the current study was not exhaustive. While previous studies on modal verbs semantics addressed the productive knowledge of the study participants, the present study focused on the receptive knowledge only. In a future study the productive knowledge of the learners should be tested with the same frequency as the receptive knowledge. Possessing receptive knowledge is associated with the initial stages of language acquisition. At these stages, students are able to understand the semantic meanings; however, they lack the ability to use the lexical items correctly. Since the main purpose of language is communication, learners should possess comprehensive productive knowledge. Investigating whether the cognitive instruction approach leads to better productive knowledge when compared to the traditional instruction approach would help language instructors to make informed pedagogical decisions and thus, rely on the most effective teaching method in their language classrooms.

Next, the students spent limited amount of time practicing the various meanings of German modal verbs. Future intervention should not only rely on explicit lexical instruction, but include teaching materials that are supplemented by communicative tasks. Instructors should acknowledge the fact that language is primarily used for communication and try to make use of real-life situations in the classroom. As Swain (1993) argues, communicative tasks provide students with opportunities for meaningful practice of the target linguistic items. According to Swain's Output Hypothesis, learners tend to notice their gap of knowledge, look for the correct answer in the input, form a hypothesis, and test this hypothesis during interaction. Michael Long (1996), in his Interaction Hypothesis argues that language learners tackle their gap of knowledge during meaningful communication by utilizing comprehension checks and clarification requests. Hence, previous research has suggested that providing students with multiple opportunities for communication would lead to better language learning.

Last but not least, the present study did not collect data regarding the participants' thinking processes during the teaching and practicing phases. Perhaps, interviewing the students after the immediate posttest and the delayed posttest could provide an understanding of how the study participants approached the learning of modal verbs various senses. Moreover, this practice would give us the opportunity to find out whether and how students utilized the two different teaching approaches.

6. Conclusion

Modal verbs appear frequently in natural discourse. However, learners of German as a foreign language experience difficulties understanding and using the various semantic meanings correctly. This difficulty might be caused by the polysemous nature of German modal verbs and the fact that their individual senses are not always transparent to the learner. Over the years, practitioners have mostly relied on the traditional instruction method, employing L1 equivalents and contextualized input, when teaching modal verbs semantics. Nevertheless, this teaching approach failed at providing precise definitions for the individual senses of modal verbs as well as clear explanation of the relationships between their prototypical and epistemic senses. In contrast, the cognitive instruction approach, based on force dynamics and metaphoric extension, has the potential to deliver clear-cut definitions for the individual senses and a systematic explanation of the relationship between the prototypical and epistemic senses.

The present study examined the acquisition patterns of the prototypical and epistemic senses of German modal verbs by investigating whether the cognitive instruction, based on force dynamics and metaphoric extensions, and the traditional translation based instruction have the potential to foster modal verbs acquisition, and which of the two approaches was more effective. Results showed that a pedagogical intervention relying on the cognitive approach might be more effective when teaching the multiple senses of German modals. Despite the limitations associated with the present study, the cognitive approach demonstrated greater potential to foster long-term acquisition of modal verbs semantics.

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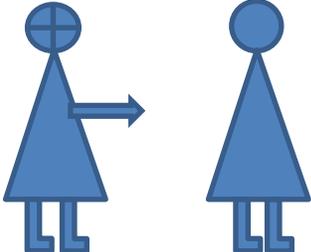
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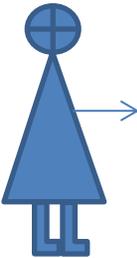
Appendix A
Meaning of the symbols used for the cognitive instruction.

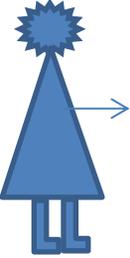| Symbol	Meaning
⊕	Own decision, free will
➡	Obligation on account of a foreign will
●	Lack of own decision, lack of free will
✸	Wish, need, desire, insecurity; desperation
→	Obligation on account of own will

Appendix B
Cognitive instruction teaching materials

	Example	Explanation
müssen	**Prototypical sense** Um 21 Uhr ist es schon dunkel. Die Kinder von Maria müssen immer spätestens um 21 Uhr zu Hause sein. **Epistemic sense**	Müssen denotes obligation extrinsically imposed by an authority figure. Maria is the external authority, who obliges her children to be home before 9 pm. The force applied by Maria is irresistible.
Additional example sentences **Prototypical :** **1**. *Wann ist die Miete fällig? Der Mieter muss am Monatsanfang die Miete bezahlen.* **2.** *Professor Schmitt kommt morgen nicht. Toll! Dann muss ich seinen Artikel nicht lesen.* **3.** *Uwe und Stefan sind gute Freunde. Uwe und Stefan müssen jeden Morgen in die Schule gehen und jeden Abend müssen sie ihre Hausaufgaben machen.* **4.** *Herr und Frau Schulze sind noch sehr jung. Herr und Frau Schulze müssen beide arbeiten und Geld verdienen.* **5.** *Dieses Buch ist sehr interessant. Professor Mann hat gesagt, dass wir dieses Buch für morgen lesen müssen.* **Epistemic:** **1.** *Anna ist nicht zur Klasse gekommen. Sie muss ihre Hausaufgaben nicht gemacht haben.* **2**. *Lara hat endlich eine gute Note in Mathematik bekommen. Sie muss jetzt zufrieden sein.* **3.** *Erik hat Anna nicht gegrüßt. Er muss sie nicht gesehen haben.* **4.** *Jürgen hat die Prüfung nicht bestanden. Seine Arbeit muss nicht gut genug gewesen sein.* **5.** *Peter wusste die Antworten zu den Fragen. Er muss das Buch gelesen haben.*	Sabine ist nicht zum Unterricht gekommen. Sie muss krank sein.	The speaker knows that Sabine is a responsible student. She never misses classes unless she is really sick. The available set of premises (Sabine did not go to class.) forces the speaker to conclude that Sabine is sick.

sollen	Example	Explanation
	Prototypical sense Um 21 Uhr ist es schon dunkel. Die Kinder von Maria sollen spätestens um 21 Uhr zu Hause sein.	Sollen compels different forces with respect to their sources of obligation (doer's internal force vs outside authority). The obligation to be home before 9 pm is externally imposed by the authority figure. However, the children are free to neglect their mother's order. The second type of obligation is internally imposed.
Additional example sentences **Prototypical :** **1.** *Der Film* Jenseits der Stille *wurde für den Oscar nominiert. Du solltest dir unbedingt den Film ansehen.* **2**. *Marie hat ihre Eltern seit zwei Wochen nicht gesehen. Sie soll ihre Eltern Besuchen.* **3.** *Frau Schulze ärgert sich über die alte Waschmaschine. Herr Schulze soll eine neue Waschmaschine kaufen.* **4**. *Meine Mutter hat ihr Bein gebrochen. Ich soll meine Mutter mit dem Auto zum Krankenhaus bringen.* **5.** *Das Auto meines Vaters ist sehr schmutzig. Ich soll nächsten Samstag Vaters Auto waschen.* **Epistemic:** **1.** *Die Polizisten verhafteten den Untermieter. Der Untermieter soll kriminell gewesen sein.* **2.** *Robert hat nicht angerufen. Er soll gearbeitet haben.* **3.** *Herr Johnson spricht sehr gut Deutsch. Er soll in Deutschland gewesen sein.* **4.** *Marie hat die Prüfung nicht bestanden. Sie soll sehr enttäuscht sein.* **5**. *Lara blieb nicht bis spät in der Disco. Sie soll müde gewesen sein.*	**Epistemic sense** Sabine ist nicht zur Schule gekommen. Sie soll einen Unfall gehabt haben.	The speaker knows that Sabine was on her way to school. Events are not following their usual trajectory. The available set of premises (Sabine did not go to school) let the speaker conclude with confidence that she might have had an accident.

wollen	Example	Explanation
	Prototypical sense Dieses Buch ist sehr interessant. Ich will das Buch kaufen.	Wollen compels internally rooted desire or preference. The doer acts upon the expressed preference and buys the book.
Additional example sentences **Prototypical:** *1. Jürgen hat seinen Freund seit Jahren nicht gesehen. Er will einen Brief an seinen Freund schreiben.* *2. Stefans Schwiegereltern kommen zu Besuch. Er will die Gäste am Flughafen abholen.* *3. Ich habe gelogen. Jetzt aber will ich die Wahrheit sagen.* *4. Wir haben ein neues Haus gekauft. Im Dezember wollen wir in das neue Haus einziehen.* *5. Der Arbeiter hat Probleme mit der Maschine. Er will den Meister sprechen.* **Epistemic:** *1. Jürgen hat seinen Freund nicht im Krankenhaus besucht. Er will von dem Unfall nichts gehört haben.* *2. Herr Wagner ist sehr nett. Er will nie Probleme mit seinen Kollegen gehabt haben.* *3. Der Schauspieler will seine Rollen schon nach zweimaligem Lesen beherrscht haben.* *4. Johnny Johns will als junger Schriftsteller großartige Erfolge gehabt haben.* *5. Jens kommt heute früh nach Hause. Er will seine Eltern telefonisch informiert haben.*	**Epistemic sense** Der Schauspieler will seine Rollen schon nach zweimaligem Lesen beherrscht haben.	The available set of premises (The actor learned his lines after reading them only twice.) triggers the speaker's doubt regarding the truth of the proposition. The speaker knows that it is almost impossible to learn the lines only after reading them twice.

mögen	Example	Explanation
	Prototypical sense Sie mag Spagetti nicht. Sie mag süβe Schokolade.	Mögen expresses internally rooted preference or taste. The doer is not forced to act upon it.
Additional example sentences **Prototypical :** **1.** *Sabine mag klassische Musik nicht. Sie mag Volksmusik.* **2.** *Jessica hat die rote Bluse als Geburtstagsgeschenk bekommen. Leider mag sie diese Bluse nicht.* **3.** *Herr Ruff, Sie haben die Suppe nicht gegessen. Mögen Sie die Suppe nicht?* **4.** *Die Tochter von Herr und Frau Schmitt ist sehr nett. Die Eltern mögen ihre Tochter sehr.* **5.** *Erika ist ins Restaurant gegengen. Erika mag das Essen in diesem Restaurant nicht so gern.* **Epistemic:** **1.** *Sie mögen recht haben, aber das interessiert niemanden.* **2.** *Herr Wagner hat ein neues Auto gekauft das sehr teuer war. Der Geschäftsmann hat ihm gesagt, dass die Preise reduziert werden. Herr Wagner mag das gewußt haben.* **3.** *Frau Krafts Komputer ist weg. Wie mag der Einbrecher wohl in die Wohnung gekommen sein?* **4.** *Erika hat einen fehlerfreien Aufsatz auf Deutsch geschrieben. Wie mag das wohl möglich sein?* **5.** *Der Räuber mag die Wahrheit sagen, aber der Richter glaubt ihm nicht.*	**Epistemic sense** Der Räuber mag die Wahrheit sagen, aber der Richter glaubt ihm nicht.	The available set of premises does not prevent the speaker from drawing a certain conclusion, but nothing seems to compel him to conclude this either. The speaker believes it is possible that the criminal is saying the truth, but it is almost as likely it is not possible.

Appendix C
Cognitive instruction learning task

Directions:
Consider the following German sentences. Based on the examples, we just looked at, do you think the used modals are appropriate for the given context/ sentence? Why or why not? Do you think there are better choices? How does choosing one modal rather than another change the meaning of the sentence?

1. How does the choice of ***müssen*** versus ***sollen*** change the interpretation of the sentence? Under what circumstances is ***müssen*** the better choice? Under what circumstances is ***sollen*** the better choice?

2. How does the choice of ***mögen*** versus ***wollen*** change the interpretation of the sentence? Under what circumstances is ***mögen*** the better choice? Under what circumstances is ***wollen*** the better choice?

Discuss the meanings of the sentences in terms of force dynamics (existing or missing forces and barriers) and decide how the different forces represented by German modals affect the semantics of the given sentences.

Part A:
> *1:* Ich habe keine Zeit dafür. Ich <u>***soll***</u> fleiβig lernen, um gute Noten zu bekommen.
> *2:* Ich habe keine Zeit dafür. Ich <u>***muss***</u> fleiβig lernen, um gute Noten zu bekommen.

Part B:
> *3:* Marie beobachtete den Verkehrsunfall aus ihrem eigenen Fahrzeug. Sie <u>***soll***</u> alles gesehen haben.
> *4:* Marie beobachtete den Verkehrsunfall aus ihrem eigenen Fahrzeug. Sie <u>***muss***</u> alles gesehen haben.

Part C:
> *1:* Diese Bluse ist altmodisch. Ich ***mag*** diese Bluse nicht.
> *2:* Diese Bluse ist altmodisch. Ich ***will*** diese Bluse nicht.

Part D:
> *3:* Der Sportler ist schon sehr schnell. Er <u>***will***</u> viel trainiert haben, aber er ist nicht der schnellste.
> *4:* Der Sportler ist schon sehr schnell. Er <u>***mag***</u> viel trainiert haben, aber er ist nicht der schnellste.

Appendix D
Traditional instruction teaching materials

müssen	
Prototypical	**Prototypical**
1. *Um 21 Uhr ist es schon dunkel. Die Kinder von Rolf müssen immer spätestens um 21 Uhr zu Hause sein.* *It is already dark at 9 pm.Rolfs children must always be home before 21 pm.*	**1.** *Um 21 Uhr ist es schon dunkel. Die Kinder von Rolf müssen immer spätestens um 21 Uhr zu Hause sein.* *It is already dark at 9 pm.Rolfs children must always be home before 21 pm.*
2. *Wann ist die Miete fällig? Der Mieter muss am Monatsanfang die Miete zahlen.* *When is the rent due? The tenant must pay the rent at the beginning of the month.*	**2**. *Wann ist die Miete fällig? Der Mieter muss am Monatsanfang die Miete zahlen.* *When is the rent due? The tenant must pay the rent at the beginning of the month.*
3. *Professor Schmitt kommt morgen nicht. Toll! Dann muss ich seinen Artikel nicht lesen.* *Professor Schmitt is not coming tomorrow. Great! In this case, I do not have to read his article.*	**3.** *Professor Schmitt kommt morgen nicht. Toll! Dann muss ich seinen Artikel nicht lesen.* *Professor Schmitt is not coming tomorrow. Great! In this case, I do not have to read his article.*
4. *Uwe und Stefan sind gute Freunde. Sie müssen jeden Morgen in die Schule gehen und jeden Abend müssen sie ihre Hausaufgaben machen.* *Uwe and Stefan are good friends. They must go to school every morning and have to do their homework every evening.*	**4.** *Uwe und Stefan sind gute Freunde. Sie müssen jeden Morgen in die Schule gehen und jeden Abend müssen sie ihre Hausaufgaben machen.* *Uwe and Stefan are good friends. They must go to school every morning and have to do their homework every evening.*
5. *Herr und Frau Schulze sind noch sehr jung. Herr und Frau Schulze müssen beide arbeiten und Geld verdienen.* *Mr. and Mrs. Schulze are still very young. They both have to work and make money.*	**5.** *Herr und Frau Schulze sind noch sehr jung. Herr und Frau Schulze müssen beide arbeiten und Geld verdienen.* *Mr. and Mrs. Schulze are still very young. They both have to work and make money.*
6. *Dieses Buch ist sehr interessant. Professor Mann hat gesagt, dass wir dieses Buch für morgen lesen müssen.* *This book is very interesting. Professor Mann said that we have to read this book for tomorrow.*	**6.** *Dieses Buch ist sehr interessant. Professor Mann hat gesagt, dass wir dieses Buch für morgen lesen müssen.* *This book is very interesting. Professor Mann said that we have to read this book for tomorrow.*

sollen	
Prototypical	**Epistemic**
1. *Um 21 Uhr ist es schon dunkel.Die Kinder von Rolf sollen spätestens um 21 Uhr zu Hause sein.* *It is already dark at 9 pm. Rolfs children should be home before 9 pm.* **2. *Der Film „Jenseits der Stille" wurde für den Oscar nominiert. Du solltest dir den Film unbedingt ansehen.*** *The movie* Jenseits der Stille *was nominated for an Oscar. You should definitely watch that movie.* **3. *Marie hat ihre Eltern seit zwei Wochen nicht gesehen. Sie sollte ihre Eltern besuchen.*** *Marie has not seen her parents for two weeks. She should visit her parents.* **4. *Frau Schulzeärgert sich über die alte Waschmaschine. Herr Schulze soll eine neue Waschmaschine kaufen.*** *Mrs. Schulze is angry at the old washing machine. Mr. Schulze should buy a new one.* **5. *Meine Mutter hat ihr Bein gebrochen. Ich soll meine Mutter mit dem Auto zum Krankenhaus bringen.*** *My mother broke her leg. I am supposed to drive my mother to the hospital.* **6. *Das Auto meines Vaters ist sehr schmutzig. Ich soll nächsten Samstag Vaters Auto waschen.*** *My father's car is very dirty. I should wash it next Sunday.*	**1. *Sabine ist nicht zur Schule gekommen. Sie soll einen Unfall gehabt haben.*** *Sabine did not come to school. Apparently, she had an accident.* **2. *Die Polizisten verhafteten den Untermieter. Der Untermieter soll kriminell gewesen sein.*** *The Police arrested the tenant. The tenant had apparently been a criminal.* **3. *Robert hat nicht angerufen. Er soll gearbeitet haben.*** *Robert did not call. Apparently, he worked.* **4. *Herr Johnson spricht sehr gut Deutsch. Er soll in Deutschland gewesen sein.*** *Mr Johnson speaks German very well. Apparently he has been in Germany.* **5. *Marie hat die Prüfung nicht bestanden. Sie soll sehr enttäuscht sein.*** *Marie did not pass the exam. Apparently she is very disappointed.* **6. *Lara blieb nicht bis spät in der Disco. Sie soll müde gewesen sein.*** *Lara did not stay late in the club. Apparently she had been tired.*

wollen	
Prototypical	**Epistemic**
1. *Dieses Buch ist sehr interessant. Ich will es kaufen.* *This book is very interesting. I want to buy it.*	**1.** *Er will davon nichts gewusst haben.* *He claims he does not know anything about that.*
2.*Jürgen hat seinen Freund seit Jahren nicht gesehen. Er will einen Brief an ihn schreiben.* *Jürgen has not seen his friend for a long time. He wants to write him a letter.*	**2.** *Jürgen hat seinen Freund nicht im Krankenhaus besucht. Er will von dem Unfall nichts gehört haben.* *Jürgen did not visit his friend in the hospital. He claims he did not know about the accident.*
3. *Stefans Schwiegereltern kommen zu Besuch. Er will die Gäste am Flughafen abholen.* *Stefan's inlaws are visiting. He wants to pick the guests up from the airport.*	**3.** *Herr Wagner ist sehr nett. Er will nie Probleme mit seinen Kollegen gehabt haben.* *Mr. Wagner is very polite. He stated that he had never had problems with his collegues.*
4. *Ich habe gelogen. Jetzt will ich aber die Wahrheit sagen.* *I lied. Now I want to tell the truth.*	**4.** *Der Schauspieler will seine Rollen schon nach zweimaligem Lesen beherrscht haben.* *The actor states that he learnes his roles after only two readings.*
5. *Wir haben ein neues Haus gekauft. Im Dezember wollen wir einziehen.* *We bought a new house. We want to move in in December.*	**5.** *Johnny Johns will als junger Schriftsteller großartige Erfolge gehabt haben.* *Johnny Johns states that he had been greatly successful as a young writer.*
6. *Der Arbeiter hat Probleme mit der Maschine. Er will mit den Meister sprechen.* *The worker has problems with the machine. He wants to speak with the expert.*	**6.** *Jens kommt heute früh nach Hause. Er will seine Eltern telefonisch informiert haben.* *Jens is coming home earlier. He claims he has notified his parents by phone.*

mögen

Prototypical	**Epistemic**
1. *Sie mag Spaghetti nicht. Sie mag süße Schokolade.* *She does not like Spaghetti. She likes sweet chocolate.*	**1.** *Er mag in Deutschland studiert haben.* *He might have studied in Germany.*
2. *Sabine mag klassische Musik nicht. Sie mag Volksmusik.* *Sabine does not like classical music. She likes country music.*	**2.** *Sie mögen Recht haben, aber das interessiert niemanden.* *They could be right, but no one is interested in that.*
3. *Jessica hat die rote Bluse als Geburtstagsgeschenk bekommen. Leider mag sie diese Bluse nicht.* *Jessica got the red blouse as a birthday present. Unfortunately, she does not like this blouse.*	**3.** *Herr Wagner hat ein neues Auto gekauft das sehr teuer war. Der Geschäftsmann hat ihm gesagt, dass die Preise reduziert werden. Herr Wagner mag das tatsächlich gewusst haben.* *Mr. Wagner bought a new, expensive car. The dealer told him that the price will be reduced. Mr Wagner might actually have known that.*
4. *Herr Ruff, Sie haben die Suppe nicht gegessen. Mögen Sie die Suppe nicht?* *Mr. Ruff, you did not eat the soup. Don't you like the soup?*	**4.** *Frau Krafts Computer ist weg. Wie mag der Einbrecher wohl in die Wohnung gekommen sein?* *Mrs. Kraft's computer has been stolen. How could the robber have entered the house?*
5. *Die Tochter von Herrn und Frau Schmitt ist sehr nett. Die Eltern mögen ihre Tochter sehr.* *The daughter of Mr. and Mrs. Schmitt is very nice. The parents love their daughter a lot.*	**5.** *Erika hat einen fehlerfreien Aufsatz auf Deutsch geschrieben. Wie mag es wohl möglich sein?* *Erika wrote an essay in German with no mistakes. How could that be possible?*
6. *Erika ist ins Restaurant gegangen. Erika mag das Essen in diesem Restaurant nicht so gern.* *Erika went to a restaurant. Erika does not like the food in this restaurant.*	**6.** *Der Verbrecher mag die Wahrheit sagen, aber der Richter glaubt ihm nicht.* *The criminal might be telling the truth, but the judge does not believe him.*

Appendix E
Traditional instruction learning task.

Directions:
Work with a partner and provide the most appropriate English equivalent for each of the German modals. Take the context of the sentences into consideration when completing the task. Provide a rationale/ motivation for your decision.

German sentences	English equivalent of the modal verb
Ich habe keine Zeit dafür. Ich *soll* fleiβig lernen, um gute Noten zu bekommen.	
Ich habe keine Zeit dafür. Ich *muss* fleiβig lernen, um gute Noten zu bekommen.	
Marie beobachtete den Verkehrsunfall aus ihrem eigenen Fahrzeug. Sie *sollte* alles gesehen haben.	
Marie beobachtete den Verkehrsunfall aus ihrem eigenen Fahrzeug. Sie *muss* alles gesehen haben.	
Diese Bluse ist altmodisch. Ich *mag* diese Bluse nicht.	
Diese Bluse ist altmodisch. Ich *will* diese Bluse nicht.	
Der Sportler ist schon sehr schnell. Er *mag* viel trainiert haben, aber er ist nicht der schnellste.	
Der Sportler ist schon sehr schnell. Er *will* viel trainiert haben, aber er ist nicht der schnellste.	