

# *The role of guided induction in paper-based data-driven learning*

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## Abstract

This study examines the role of guided induction as an instructional approach in paper-based data-driven learning (DDL) in the context of an ESL grammar course during an intensive English program at an American public university. Specifically, it examines whether corpus-informed grammar instruction is more effective through inductive, data-driven learning or through traditional deductive instruction. In the study, 49 participants completed two weeks of ESL grammar instruction on the passive voice in English. The learners participated in one of three instructional treatments: a data-driven learning treatment, a deductive instructional treatment using corpus-informed teaching materials, and a deductive instructional treatment using traditional (i.e., non-corpus-informed) materials. Results from pre-test, post-test, and delayed post-test indicated that the DDL group significantly improved their grammar ability with the passive voice, while the other two treatment groups did not show significant gains. The findings from this study suggest that in this learning context there are measurable benefits to teaching ESL grammar inductively using paper-based DDL.

Keywords: data-driven learning, guided induction, ESL grammar

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## 1 Introduction

Language corpora and corpus-informed teaching materials have been used in language teaching over several decades, and the predominant model of teaching with corpora in as been data-driven learning or DDL, originally developed and promoted by Johns and colleagues (Johns, 1991; Johns & King, 1991). DDL allows learners to inductively discover language structures and patterns through interacting with concordancing software or with concordance-based instructional materials. Although researchers and proponents of corpus-informed instruction have been cautiously optimistic about the potential of DDL in language teaching since Johns' groundbreaking work, direct uses of corpora in language teaching have not been widely adopted (Conrad, 2005; Flowerdew, 2012; Römer, 2006). The goal of this paper is to examine the role that guided induction plays in DDL-based ESL grammar instruction through a classroom-based study comparing DDL with more traditional approaches to grammar instruction.

Classroom-based research on learning outcomes and learner attitudes towards DDL has been carried out in several areas of language learning. Much of this research has been in the field of vocabulary learning (cf. Boulton, 2010a, 2012 for comprehensive lists of empirical

DDL research). Researchers have also seen the potential for corpora to contribute to grammar instruction, as corpus-based research in grammar has contributed greatly to descriptive linguistics (Conrad 2000, 2005). There have been several classroom-based studies of teaching grammar with DDL, including work by Belz and Vyatkina (2005a, 2005b, 2008), Boulton (2008, 2009a, 2009b, 2010b), Chambers and O'Sullivan (2004), Conroy (2010), Estling Vannestål and Lindquist (2007), Gaskell and Cobb (2004), Hadley (2002), O'Sullivan and Chambers (2006), Pérez-Paredes, Sánchez-Tornel and Alcaraz Calero (2012), Pérez-Paredes, Sánchez-Tornel, Alcaraz Calero and Aguado Jiménez (2011), Tian (2005a, 2005b), Whistle (1999), Yoon (2008) and Yoon and Hirvela (2004). Many of these studies have measured learners' attitudes and experiences with DDL and grammar instruction, and some have also measured learning outcomes and found benefits to using DDL in grammar instruction. Though there is evidence to support such uses of DDL, it is not entirely clear whether the benefits are a result of the inductive approach to language instruction, the use of corpus-informed materials and tools, or a combination thereof. In short, there is still a need for further research to understand how the inductive approach to DDL contributes to language learning (Flowerdew, 2009).

### *1.1 Types of data-driven learning and corpus-informed textbooks*

Despite the research supporting DDL, a recent trend over the last decade in developing corpus-informed grammar textbooks, has not been the incorporation of an inductive approach to grammar learning, but rather the presentation of information from corpora and corpus-based research about grammar in an explicit, rule-centered framework which runs counter to the inductive principles inherent in DDL (cf. Conrad & Biber, 2009; McCarthy, McCarten & Sandiford, 2005; Reppen, Bunting, Diniz, Blass, Iannuzzi & Savage, 2012). While there are examples of corpus-driven grammar books that are not purely rule-based (e.g., Thornbury, 2004), they remain rare. The apparent contrast between DDL research on grammar instruction and corpus-informed grammar textbooks could, perhaps, be dismissed as an effect of the fundamental difference between a textbook and an in-class approach to instruction based around learner-centered, computer-based activities.

However, over the history of DDL, there has been a range of approaches to learning from corpora as outlined in Mukherjee (2006: 12), varying in the degree of learner autonomy and the degree to which computers and concordancing software have been used directly by learners. Since Johns' early work in DDL, a popular instructional strategy has been to have learners interact directly with corpora using concordancers to conduct their own searches of language features and patterns. However, as an example of rethinking traditional computer-based DDL, Boulton (2010b) demonstrates that DDL can still be effective with prepared, preselected inductive activities based on corpora, and that this type of less autonomous, paper-based DDL may actually be more effective with certain groups of learners.

In fact, interacting directly with corpora is not a necessary part of DDL, nor is it always desirable. Hands-on DDL faces several hurdles, including helping learners understand what a corpus is and why it would be a useful tool in language learning, familiarizing learners with a concordancer (often using a software interface not in their L1), and helping learners decide what language features can be used with the software. A teacher must carefully consider these potential challenges when considering implementing DDL in a grammar classroom. Boulton (2010b) suggests that when working with lower-level learners

especially, using computers for DDL is possibly an unnecessary complication when activities with pre-prepared DDL materials can accomplish many of the same goals. There are other situations, additionally, where using prepared DDL materials instead of having learners interact directly with corpora may be more beneficial. For learners who are unfamiliar with using software in language learning and for those who are unaccustomed to inductive or learner-centered activities, the challenge of directly interacting with corpora may have the unintended result of inhibiting learning instead of being a benefit.

So DDL, in its use over the last few decades, is not necessarily characterized by direct interaction with language corpora or by total learner autonomy. Rather, I propose that two particular characteristics define DDL:

- 1) real language data are used as sources of language learning materials or reference resources;
- 2) learning activities are student-centered and focus on language discovery.

DDL, under this definition, is not based on having learners work semi-autonomously with concordancing software, but rather relies on carefully designed and scaffolded activities to help learners discover language structures through working with real language samples, whether on computer or not. In this sense, explicit presentations of rules in corpus-informed grammar textbooks and discovery learning through DDL are not solely distinguished from one another by mode of delivery, but also in their understanding of how grammar is learned. Only the first characteristic listed above, using language from authentic texts as a tool for learning, has been a consistent link between DDL research and the recent emergence of corpus-informed textbooks. In fact, the benefits of using corpus-based language samples and language descriptions have been the foundation of both DDL research and the development of corpus-informed grammar textbooks.

In both hands-on and paper-based DDL the pedagogical approach focuses on induction as a learning strategy (Flowerdew, 2009; Mukherjee, 2006). The assumption is that there is an inherent connection between inductive language discovery and corpora as learning tools, and this assumption is not shared by the aforementioned corpus-informed grammar textbooks like the *Touchstone* series (McCarthy *et al.*, 2005), *Real grammar* (Conrad & Biber, 2009), or *Grammar and beyond* (Reppen *et al.*, 2012). Rather, these texts present information about language deductively with explicit information about grammar rules and patterns. The existence of textbooks in parallel with DDL-based approaches to grammar instruction outlines an important question, in the current research on learning with corpora, of whether instruction benefits from an inductive or a deductive approach. When the current research on DDL has shown positive learning outcomes, are these gains attributable to the use of corpus-informed teaching materials and tools, or to the inductive approach of DDL, or both?

### ***1.2 Guided induction in data-driven learning***

At the less autonomous end of Mukherjee's (2006) cline of DDL, learning through preselected concordance materials does not necessarily entail a purely inductive approach. Rather, the language discovery activities are guided and facilitated by an instructor (Boulton, 2010b; Flowerdew, 2009; Stevens, 1991). Research on the pedagogical approach of guided induction has sought to examine best practices of teacher-facilitated discovery learning in second language teaching. Sinclair (2003), in particular, models how facilitated

discovery learning can be accomplished through the use of concordancing tools. In L2 grammar pedagogy, the question of inductive or deductive approaches is especially relevant, as explicit grammar teaching has historically first lost and then regained favor among language teachers and researchers over the last few decades (Ellis, 2006; Hammerly, 1975; Herron & Tomasello, 1992), resulting in no clear agreement on the best ways to teach grammar, regardless of the source or type of teaching materials – or even if grammar should be taught at all (Haight, Herron & Cole, 2007). While there is no one universally approved form of explicit instruction (whether deductive or inductive), there is some consensus among language learning researchers that explicit instruction in grammar does benefit language learners (Herron & Tomasello, 1992; Norris & Ortega, 2000).

Guided induction, as an approach that provides a structured, scaffolded framework for inductive learning, places the learner at the center of the learning task, with the learner seeking to discover the nature of the grammar structure through interacting with the language. Many early inductive approaches were criticized for simply having learners work with examples first before the teacher presented the grammar rules; instead, as Herron and Tomasello (1992: 709) observe, the learner's involvement in discovering the language may help him/her to internalize the target items. Guided induction is a particular evolution of the inductive approach where learners are first presented with language samples in the form of an interactive task that guides them to discover the language structure they contain; the teacher has an active role in facilitating these tasks, but typically does not present explicit grammar rules. Learners are then guided to produce the language structure in meaningful communicative tasks (Haight *et al.*, 2007; Herron & Tomasello, 1992; Shaffer, 1989).

Proponents of guided induction contend that this approach allows learners to develop generalizable abilities to formulate and make their own observations about language. An additional benefit is that through inductive learning tasks, which are potentially more interactive than traditional deductive tasks, learners engage more and receive direct feedback from their language teachers as they seek to construct and refine their hypotheses about the targeted language structures (Herron & Tomasello, 1992: 716). Critics of discovery-oriented learning, however, point out that the preponderance of educational research indicates that more learning occurs when learners are given greater guidance (e.g., Kirschner, Sweller & Clark, 2006). Minimally guided approaches to instruction, according to Kirschner *et al.*, compared with more guided approaches, do not lead to similar gains in long-term retention or skills development. The relevant recommendations, based on a survey of the last half-century of research on various forms of minimal guidance instruction by these researchers, are that learners need to be provided with adequate guidance and scaffolding, and that educators should not confuse the general practices of inquiry and research in a discipline as being the same as what learners need to learn about the field.

In the case of language instruction, Flowerdew (2009) outlines a guided approach to DDL where the instructor helps learners through the language discovery process without explicitly providing them with grammar rules, but with accommodation for varying levels of teacher guidance and scaffolding. This approach, first outlined as three steps for corpus-based research enquiries by Carter and McCarthy (1995), has been updated to include an intermediary intervention step by Flowerdew (2009):

1. Illustration: looking at data.
2. Interaction: discussion and sharing observations and opinions.

3. Intervention: optional step to provide learners with hints or clearer guides for induction.
4. Induction: making one's own rule for a particular feature.

Consequently, corpus-based activities in this guided inductive approach would begin with learners looking at pre-selected examples of language data. They are then guided by the teacher to make observations, typically through group- or pair-based problem-solving activities, to identify patterns or trends about the language data. At this point, the teacher can if necessary intervene with careful hints or suggestions for the learners to help them accomplish the problem-solving activities. Finally, the learners are guided to complete subsequent activities using the patterns of the grammar feature under review.

### *1.3 The range of corpora in DDL for grammar instruction*

An additional methodological distinction between the emergence of corpus-informed grammar textbooks and the development of DDL grammar teaching materials and tools lies in the differences in the types of corpora used. Whereas corpus-informed textbooks are often based around large general corpora designed to represent broad areas of language use (cf. Conrad & Biber 2009; Reppen *et al.*, 2012), classroom research into using DDL as an instructional approach has drawn from a much wider range of corpora.

Some studies of teaching grammar with hands-on DDL have employed large, general corpora that are accessible through web interfaces. These include corpora like COBUILD (Estling Vannestål & Lindquist, 2007; Yoon, 2008), along with other large, web-based corpus tools (Gaskell & Cobb, 2004; Hanafiyeh & Keshi, 2013). Other studies have used corpora built to focus on specific areas of language use or even with a teaching focus, such as using parallel corpora that present matching corpus lines in the target language and the language of instruction (Chujo, Anthony & Oghigian, 2009; Chujo & Oghigian, 2012; Schmied, 2006). Belz and Vyaktina (2005a, 2005b) had learners build their own corpus and work on both hands-on and paper-based learning activities; in other studies, researchers themselves have built smaller corpora for specific pedagogical purposes (C. Chang & Kuo, 2011; P. Chang, 2012; Hadi & Alibakshi, 2012).

More specifically, in studies where the focus has been on *paper-based* DDL grammar instruction, the range of corpora is similarly broad, but here it is the teacher who interacts with the corpora. Whereas in hands-on studies the learners interact directly with corpora, in paper-based studies, the researchers use corpora as a tool for developing instructional materials (most often in the form of concordance lines or activities derived from concordances). Boulton (2008, 2010b) used the British National Corpus for developing instructional materials in paper-based DDL; Sripicharn (2003) similarly used the Bank of English to produce concordance data for DDL activities; and Tian (2005a, 2005b) developed paper-based instructional materials using online news sources.

## **2 The study**

Following Boulton's (2010b) model of teaching using corpora without computers, this study compared the learning outcomes from three groups of learners each participating in a different instructional treatment. The first group (data-driven learning, henceforth DDL) completed a guided inductive treatment using the aforementioned practices in

Table 1 Participant information by treatment group

	DDL	DCI	TGI	Total
Female	4	2	5	12
Male	12	13	13	37
L1 Arabic	11	13	13	37
L1 Chinese	5	2	5	12
Total	16	15	18	49

Table 2 Mean scores on general test of grammar ability

	Test Scores	
	<i>M</i>	<i>SD</i>
DDL	40.62	6.98
DCI	37.79	5.09
TGI	41.34	3.27

paper-based DDL. The second group (i.e., deductive, corpus-informed instruction, henceforth DCI) completed a deductive, rule-based instructional treatment using teaching materials derived from language corpora. Finally, to provide a baseline for comparison, a third instructional group received traditional grammar instruction (TGI) using conventional teaching materials. The participants in each group first completed a pre-test on the grammatical structure of the passive voice, then over the course of two weeks received four hours of instruction and practice on this. They completed an immediate post-test following instruction, and a delayed post-test two weeks later.

## 2.1 Participants

Volunteer participants were recruited from three advanced grammar classes in an intensive English program at a regional public American university. The learners were L2 learners of English who had completed, on average, 5.4 years of English study, and had a mean age of 22. In addition to the grammar class, the learners also took courses in listening and speaking, composition, and reading and vocabulary. Of the 49 participants, 38 were male and 11 were female. All participants were from one of two L1 language backgrounds: Chinese was the first language for 12 participants and Arabic for the remaining 37. Neither sex nor the L1 were controlled for, as pre-existing classes were used for the study. However, the three groups (DDL, DCI, and TGI) had similar distributions of Chinese and Arabic speakers and of males and females (Table 1).

Prior to the instructional treatment, all participants completed a general test of grammar knowledge based on the structure section of the paper-based TOEFL (i.e., section 2) (Table 2). A one-way ANOVA of the participants' mean scores indicated no significant differences between the three treatment groups,  $F(2, 43) = .988, p = .38$ .

The researcher was also the classroom instructor for all three groups. This decision was made in order to maintain as consistent instruction as possible across the three groups and to control for variation in teaching style and related effects. In order to reduce the possibility of influencing the outcome of the instructional treatments (i.e., via a Hawthorne effect), the teacher kept a reflective journal of his own behavior in each of the classes, both prior to and during the instructional treatments, as a way to monitor interactions with the treatment groups. Each of the three classes met twice weekly for one-hour sessions, and the study was conducted over a three-week period, with four class periods (i.e., four hours) dedicated to instruction on the active and passive voice.

## 2.2 Instructional treatments

Each grammar class received instruction on the passive voice using a different instructional approach. For the two corpus-informed treatment groups (DDL and DCI), teaching materials were developed using available corpus-based descriptions of the passive voice (Biber, Johansson, Leech, Conrad & Finegan, 1999; Conrad & Biber, 2009); an example of a data-driven activity is provided in Appendix A. Grammar teaching materials for the two approaches to corpus-informed instruction were developed using an operational framework for describing the passive voice based on Celce-Murcia and Larsen-Freeman's (1999; also Larsen-Freeman 2001) three-dimensional model of *Form – Meaning – Use*. Information on use included simple register differences in use (between speech and academic writing) as well as differences in use between 'short' and 'long' passives.

Authentic language samples were also used in developing materials, the samples being taken from academic prose and news articles from two publicly available online corpora: the TIME Magazine corpus (Davies 2007) and the Corpus of Contemporary American English (Davies 2008). Whenever possible, the language samples were used for materials for both corpus groups.

In the DDL group, the instructional approach was based on the principles of guided induction and followed the 'four I's outlined in Flowerdew (2009): illustration, interaction, intervention, and induction. Specifically, the participants received preselected language samples (as printed concordance lines) that were designed to illustrate specific differences in form, meaning, and use of the passive voice. The participants worked in small groups and in jigsaw activities to identify and explain what they found in the examples. Following the discovery activities, they shared their findings with the class in a discussion activity, revised their findings according to feedback from classmates, and then completed additional productive writing activities where they applied their rules.

The DCI group used corpus-informed materials in a deductive instructional approach. The instruction followed the widely used instructional approach of Presentation – Practice – Production (PPP). This group first received corpus-informed grammar rules about the passive voice, including information about form, meaning, and use. They then practiced different forms of the passive voice in different contexts (in exercises designed using sentences taken from the corpora), and then produced the target structures in the same short writing activities as the DDL group.

As a point of comparison, the TGI group received grammar instruction following the same deductive instructional approach as the DCI group (i.e., PPP), but used traditional grammar teaching materials instead of corpus-informed descriptions of rules and activities. This group

Table 3 Test task descriptions

Task description	Task measures	# of items
<i>Error correction.</i> Participants revise incorrect uses of multi-word verbs in sentences and mark correct uses as correct.	Knowledge of form and meaning	3
<i>Rewrite sentences.</i> Participants rewrite sentences in either the active or passive voice.	Knowledge of form	2
<i>Register choice.</i> Participants determine which sentence type would be more appropriate by register (speech or writing)	Knowledge of use	2

first received instruction on the form, meaning, and use of the passive voice based on widely used grammar textbooks, and then completed practice activities from the textbooks. Following the practice, they also produced the passive voice in short writing tasks.

### 2.3 Instruments

Prior to the instructional period, the participants in all three groups were given a short pre-test of their grammar ability related to the active and passive voice in English. Immediately following the two weeks of instruction, the participants completed another test with the same test tasks. Then, two weeks following the instructional period, participants completed a delayed post-test, again with the same test tasks. Given the short duration of each class period (60 minutes), the tests were designed to be short demonstrations of the participants' overall grammar knowledge in relation to the active and passive voice in English through different tasks.

The pre-test, post-test, and delayed post-test all consisted of three tasks (see sample test in Appendix B) that were designed to measure ability related to form, meaning, and use (Table 3). The first task was to determine if sentences contained errors in the use of either the active or passive voice, and if so, to correct the error. This task was designed to measure the participants' knowledge of the form and meaning of the active and passive voice. The second task was to rewrite active sentences into the passive voice or vice versa; and in the third task, participants had to decide which type of sentence would be more appropriate based on the register of use (i.e., speech or academic writing).

The goal of the register awareness task was to measure participants' immediate ability to distinguish which use of a particular voice was appropriate in one of the two major registers of speech and academic writing (Biber, 1988). Understanding how registers differ based on language structure is a valuable area of language ability for learners (Aguado-Jiménez, Pérez-Paredes & Sánchez, 2012), and while simplistic, the task was designed to provide some feedback on how the instructional treatments may have affected participants' awareness of register differences.

### 2.4 Analysis

The participants' performance on the three tests were scored and mean scores were calculated across the groups (Table 4). As the data met the assumptions of normality for



Table 4 Mean scores for active/passive voice tests

	Pre-test		Post-test		Delayed Post-test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
TGI	2.69	.75	3.69	1.03	2.62	1.04
DCI	2.60	1.35	3.30	1.70	2.80	1.03
DDL	3.36	1.03	5.09	.94	4.82	1.40

Table 5 One-way ANOVA of pre-test scores on passive voice

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Between Groups	2	2.24	1.12	1.038	.36
Error	41	44.19	1.08		
Total	43	46.43			

parametric analysis, ANOVA tests were conducted to determine whether there was improvement during the study among the three groups. Initially, a one-way ANOVA was conducted on the participants' pre-test scores to determine if there were differences between groups prior to the instructional treatment. Subsequently, Repeated Measures ANOVAs were conducted for each treatment group to measure their performance on the three assessment tasks over time. Additionally, scores on individual test tasks were analyzed to compare performance across the three treatment groups. However, as these individual task scores were based on low point values and did not individually meet the assumptions of normality or sphericity, non-parametric Kruskal Wallis H tests were used in this stage of the analysis.

### 3 Findings

The one-way ANOVA on pre-test scores failed to indicate significant differences between the three treatment groups prior to instruction,  $F(2, 43) = 2.993$ ,  $p > .05$  (Table 5). This suggests that the participant groups were at the same ability at the beginning of the instructional period.

The RMANOVA analyses revealed that the overall tests of passive voice ability can distinguish between the three groups. The DDL group showed statistically significant increases in their mean scores from the pre-test to the post-tests while the other two groups did not.

*TGI group*: mean scores from this group increased somewhat from the pre-test to the post-test, but decreased in the delayed post-test (delayed post-test scores were very close to pre-test scores). The RMANOVA of overall test scores for the TGI group indicated that there was a significant main effect for test,  $F(2, 24) = 7.06$ ,  $p < .05$  (Table 6). However, pairwise comparisons indicated that the increase in mean scores from pre-test to post-test was not significant ( $p = .02$ ) when using a Bonferroni adjustment of  $\alpha^1 = .05/3 = .017$  to

Table 6 RMANOVA of TGI test scores

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\eta^2$
Test	2	9.39	4.69	7.06	.004	.37
Error	24	15.95	.67			

Table 7 One-way RMANOVA of DCI active/passive test scores

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\eta^2$
Test	2	2.60	1.30	.594	.56	.133
Error	18	39.40	2.19			

Table 8 One-way RMANOVA of DDL active/passive test scores

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\eta^2$
Test	2	18.97	9.49	13.207	.000	.569
Error	20	14.36	.72			

calculate significance. Rather, the comparisons revealed that the significant main effect was due to a significant decrease in mean scores from the post-test to the delayed post-test ( $p = .001$ ). These results indicate that the gains from pre-test to post-test were not significant while the decrease following the instructional period (i.e., from post-test to delayed post-test) was, in fact, significant. Consequently, there is no evidence of measurable learning from the TGI instructional treatment.

*DCI group:* the one-way RMANOVA failed to show a significant main effect for test,  $F(2, 18) = .594$ ,  $p > .05$  (Table 7). The changes in mean scores between pre-test (2.60), post-test (3.30), and delayed post-test (2.80) were not significant for this treatment group, suggesting that while the mean scores did increase from the pre-test to the post-tests, the gains were not statistically significant.

*DDL group:* a one-way RMANOVA of overall test scores indicated that there was a significant main effect for test for this group,  $F(2, 20) = 13.207$ ,  $p < .05$  (Table 8). In the *post hoc* analysis, pairwise comparisons indicated that the increase in mean scores from pre-test to post-test was significant ( $p = .000$ ), as was the increase from pre-test to delayed post-test mean scores ( $p = .009$ ) based on the parameters of the aforementioned adjusted alpha. The decrease in mean scores from post-test (5.09) to delayed post-test (4.82) was not statistically significant ( $p = .43$ ). Based on these findings, it is reasonable to conclude that the DDL instructional treatment led to a significant increase in grammar performance for this group and that these gains were maintained over time, indicative of an instructional effect from the treatment.

Table 9 Mean scores for error correction task

	Pre-test		Post-test		Delayed Post-test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
TGI	1.15	.99	1.00	.71	.85	.69
DCI	1.20	.79	1.10	.88	1.20	.79
DDL	1.27	.79	2.00	.45	1.82	.75

Table 10 Mean scores for sentence rewriting task

	Pre-test		Post-test		Delayed Post-test	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
TGI	.00	.00	1.08	.95	.38	.51
DCI	.00	.00	.50	.71	.30	.48
DDL	.45	.52	1.45	.69	1.27	.65

### 3.1 Individual test tasks

Following the analysis of the overall tests of the active/passive voice, analyses of the three test tasks were conducted individually. The first task, error correction, measured participants' receptive and productive grammar ability associated with the *form* of the active/passive voice construction. Scores on the pre-test, post-test, and delayed post-test tasks are reported in Table 9. The Kruskal-Wallis analysis failed to show any differences between the three treatment groups on the pre-test performance for this task ( $H(2) = .412$ ,  $p = .814$ ). On the post-test, the scores did differentiate significantly between the three groups ( $H(2) = 11.083$ ,  $p = .004$ ), with a mean rank of 13.15 for TGI, 25.05 for DDL, and 14.85 for DCI. Analysis of the delayed post-test also indicated a significant difference between the treatment groups ( $H(2) = 7.863$ ,  $p = .02$ ), with a mean rank of 12.77 for TGI, 23.45 for DDL, and 17.10 for DCI. The DDL group outperformed the other two groups on both the post-test and the delayed post-test for this task.

On the second task, rewriting sentences in the active/passive voice, the analysis showed significant difference between the three treatment groups on the pre-test ( $H(2) = 11.897$ ,  $p = .003$ ), with a mean rank of 15.00 for TGI, 22.73 for DDL, and 15.00 for DCI. While the previously reported analysis of overall scores for the active/passive voice did not show a significant pre-test difference between the three treatment groups, this analysis suggests that the participant groups did not have the same ability level related to this particular task at the beginning of the instructional treatments. Specifically, the mean scores for the TGI and DCI groups were lower than the DDL group on the pre-test (Table 10). The TGI and DCI participants both had a mean score of 0.00 on this task, with the DDL participants scoring only slightly higher ( $M = .45$ ). Analysis of the post-test scores for this task also indicated a significant difference between treatment groups ( $H(2) = 6.354$ ,  $p = .042$ ), with a mean rank of 18.04 for TGI, 22.05 for DDL, and 11.80 for DCI. Analysis of the delayed post-test

Table 11 Mean scores for register awareness task

	Pre-test		Post-test		Delayed	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
TGI	1.54	.78	1.62	.51	1.38	.51
DCI	1.40	.70	1.70	.48	1.30	.68
DDL	1.64	.67	1.64	.51	1.73	.47

scores showed an even greater (and statistically) significant difference between groups ( $H(2) = 12.543, p = .002$ ), with a mean rank of 14.27 for TGI, 25.41 for DDL, and 13.00 for DCI. The differences between the DDL group and the other two groups that were present at the pre-test were continued through the post-tests, with DDL scoring higher on all three tasks.

For the third, register awareness task, the mean results of group scores by test are reported in Table 11. Analysis of these scores indicated that there was no significant difference between treatment groups on the pre-test ( $H(2) = .949, p = .622$ ), on the post-test ( $H(2) = .180, p = .949$ ), or on the delayed post-test ( $H(2) = 3.427, p = .180$ ). Although this task was designed to distinguish between the corpus-derived instructional treatments and the traditional instruction as a measure of language performance directly related to the type of information corpora can provide, it did not provide any meaningful discrimination between groups.

#### 4 Discussion

The results of the analysis present a complex picture of how these three instructional treatments differ in terms of learning outcomes. From the analysis of the overall test scores, DDL led to clear gains in learning from pre-test to post-test that were maintained into the delayed post-test. The other two groups did not show the same improvement. However, the more detailed task-specific analysis revealed that within the overall test scores, one task in particular, the error correction task, was a better indicator of group differences than the other two tasks, when considered individually.

Given that the two corpus-informed instructional approaches included information about register differences in the use of passive voice, the fact that the register awareness task did not indicate any differences between the three groups was somewhat surprising. However, as the register awareness information was limited to broad differences between speech and academic writing, this may be a limitation of the practical scope of the instructional materials as much as of the testing instrument.

On the other hand, the differences that emerged between the three groups on the error correction task may relate directly to the inductive nature of the DDL instructional approach. As learners in this treatment group completed detailed, learner-centered analyses of sentences with passive voice constructions and were responsible for identifying and explaining this information, this may have played a role in their knowledge of the accurate form and meaning of sentences that use the passive voice. As the DDL group improved on this task from pre-test to post-test, and the DCI group did not, it seems reasonable to

conclude that the improvements were in part related to the combination of the inductive instructional approach along with the use of real language from corpora and not solely the latter.

Based on the teacher's own reflective note taking during the instructional treatments, the three groups received the same amount of time on tasks and interacting with language samples. However, an important difference that emerged during the treatment was that the participants in the DDL group, due to the nature of the learning tasks, engaged with the language learning activities and the sample language in ways that the other learners did not. They discussed the examples with their classmates in an effort to discover patterns in the language and to solve problems; whereas the students in the other treatment groups primarily referred to the rules they had available to complete learning tasks. The DDL learners' engagement with the material and interest in what many perceived as a novel approach to grammar instruction may have led to more learning during the course of this brief instructional intervention.

Finally, this study has provided some evidence that in comparison with traditional grammar instruction (e.g., PPP) and more conventional instructional materials, inductive paper-based DDL can be a valuable resource for language teachers. The practical design of the approach to DDL in this study (i.e., developing materials using online corpora, consulting pre-existing corpus-based research, and not requiring the use of computers in the classroom) is an instructional approach that should be accessible in a broad range of language learning contexts. This approach is certainly not novel in the field of DDL (cf. Boulton, 2010b), but this small-scale study of teaching one grammar feature using DDL may provide further support for educators interested in the possible benefits of using this approach in language classrooms.

#### ***4.1 Limitations and further research***

While these results provide some limited evidence that this combination of inductive instruction with corpus-informed teaching materials can lead to greater outcomes, caution must be used in generalizing the findings. The study focused primarily on rather concrete 'rules' for the grammatical differences between the active and passive voice, taking a narrow view of what a grammar structure is and also, due to the constraints of using real grammar classrooms with immediate curricular goals, taking only limited advantage of the possibilities of using corpus-informed teaching materials for providing more robust insight into register and use differences between the two voices in English. Further study of this type of instructional intervention may be better addressed by integrating these instructional treatments into a teaching approach that incorporates communicative language learning as the basis for learning about register and uses of the target language feature. Additionally, the passive voice, as a grammatical construction, may be simpler to learn using DDL than other, more complex grammar structures (in terms of form, meaning, and use).

### **5 Conclusion**

This study used a guided inductive approach to paper-based data-driven learning that followed the four-stage instructional sequence proposed by Flowerdew (2009). Historically, DDL studies have varied both in instruction methods and in technologies used, limiting both generalizability and a cohesive framework for applying DDL, but the results of this study

suggest that using a well-structured, guided inductive approach for DDL (especially in paper-based contexts) can lead to positive learning outcomes, and that there is more to DDL as an instructional approach than simply using corpora as a teaching tool. Future corpus-informed approaches to grammar instruction that incorporate this or a similar DDL framework and consider a range of grammatical features may provide a more robust understanding of how inductive, corpus-informed approaches to grammar instruction may be beneficial to language learners.

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## Appendix A

### Data-driven Activity for Passive Voice

Read each of the following sentences. Underline the use of the verb “measured” in each sentence. Then, with a partner, circle the subject of each sentence and answer the questions below.

1. Richardson and his colleagues measured the expansion rate of the plume.
2. The same researchers measured the immune response of human subjects to soybeans using a skin-prick test—an evaluation used often by allergy doctors.



3. During a 1958 flood, for example, sediment levels in the river were measured at 35 pounds per cubic foot, and an observer described its surface as " wrinkled. "
4. The height values were measured as recommended by the CDC
5. Kashlinsky's team measured cluster motions relative to the cosmic microwave background.
6. Fifty years ago franchise fees and costs were measured in the hundreds of thousands of dollars.

What subjects did you circle for sentences 3, 4, and 6?

In these sentences who was doing the *measuring*?

In sentences 1, 2, and 5, who is doing the *measuring*?

Look back carefully at the verbs in each sentence. The verb *measured* appears differently in sentences 3, 4, and 6. How so?

When the subject of the sentence is doing the *measuring* which verb is used?

When the subject isn't doing the *measuring*, which verb do we use?

### Appendix B Post-test Active/Passive Voice

**Part 1.** Read the following sentences. If a sentence is grammatically correct, write "correct" in the space provided. If the sentence is not correct, revise the sentence in the space provided. The first two are done for you.

0. The drug was being used by athletes.

Correct

00. In Los Angeles it often seems as though screenplays are being writing by everyone who can put a noun and a verb together.

*In Los Angeles it often seems as though screenplays are being written by everyone who can put a noun and a verb together.*

1. The story is illustrated a portfolio of photographs of Mr. Ford on the job.

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2. Last week 3.3 million Americans learned within the past year that their names had been used to open fraudulent bank or credit-card accounts.

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3. Nerve gas was using on enemy troops attempting a counterattack on the U.S. forces.

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**Part 2.** The following sentences are all correct. However, they need to be rewritten to make them more appropriate for speech/writing. Rewrite the passive voice verbs to active voice verbs and the active verbs to passive. The first one has been done for you.

0. A wide range of trees suitable for firewood characterizes the forest.

**The forest is characterized by a wide range of trees suitable for firewood.**

1. They will have taken a big step on the road to peace.

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2. \$30,000 was given to me by my father.

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**Part 3.** Determine which version of the sentence sounds better in speech or writing. Circle your answer.

1. Sentence from writing

- A. The client's annual advertisement spending measures the size of an account.
- B. The size of an account is measured by the client's annual advertisement spending.

2. Sentence from speech

- A. My children asked me this kind of a pivotal question about childhood beliefs.
- B. I was asked by my children this kind of a pivotal question about childhood beliefs.