

The effect of using an online-based course on the learning of grammar inductively and deductively

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Abstract

This study aims at exploring the effectiveness of using an online-based course on the learning of sentence types inductively and deductively. To achieve this purpose, a computer-mediated course was designed. The sample of the study consists of four groups taught under four treatments of grammar: (1) with computer-based learning inductively, (2) with computer-based learning deductively, (3) with non-computer-based learning inductively, and (4) with non-computer-based learning deductively. A pre-test/post-test design (between-subject) is used to investigate the effect of two factors: method (computer-based learning vs. non-computer-based learning) and technique (induction vs. deduction) on the students' learning of sentence types. The results reveal a new manner of enhancing grammar learning based on the level of language structure complexity. The computer-based learning method is found to be functional for more complex and elaborate structures, like the complex sentence and compound complex sentence, and more complicated grammar structures need to be taught by means of the deductive technique. None of the inductive and deductive techniques is reported to be more practical with simple grammar structures such as the simple sentence and compound sentence.

Keywords: Computer-based learning, online learning, grammar, induction, deduction

1 Introduction

There has been tremendous worldwide growth in using computer-based methods for learning different language skills and components. Computer-based instruction has also been taken up eagerly by the foreign language teaching community. The computer has been used as a tool and tutor during the last two decades for teaching different language areas such as grammar to learners of English as a Foreign Language (EFL). It assists students' linguistic development because it provides more opportunities for language learning than face-to-face instruction. Computer-based learning is an improvement over non-computer-based learning as it provides more feedback for the user and can also be easy to access. The material is presented in a more individualized way which makes it easier for each learner to process it at his/her own pace. The user can also request help individually, which reduces his/her

anxiety. Generally, computer-based learning seems to be a more relaxed atmosphere for language learning, as compared to non-computer-based learning.

Language teachers and practioners need to set parameters for genuine communication between learners. One of the ultimate goals of computer-assisted language learning (CALL) is to provide learners with a good environment that facilitates communicative linguistic interactions. One of the CALL contexts which is helpful for language learning and teaching is online language learning. McLinden *et al.* (2006) and Oliver and McLoughlin (2000) argue that the broader literature concerned with effective online teaching and learning provides an appropriate context within which technology can be used to support the learner's involvement in collaboration, authentic tasks, reflection, and dialogue. In online learning, the computer should be used as an instrument or tutor that facilitates learning, not an end for language learning. Uden and Beaumont (2006) suggest that one of the challenges we face is to integrate online learning technologies where they support the learner. Pedagogy should come first, and technology should support rather than conflict with pedagogy. This study is based on the assumption that a computer-based learning context is used as a tutor to provide students with opportunities for language learning and teaching, through which language learners' grammatical rules develop. Chen (2006) also argues that multimedia tutorial programs are helpful in developing grammar learning.

1.1 Research in computer-based grammar learning

Some studies demonstrate the functions and benefits of computer-based grammar learning. Hall (1998) argues that a varied application of CALL and information technology (IT) can be used to overcome the deficit of sketchy knowledge of grammar by a combination of approaches including explicit, implicit and exploratory grammar teaching. To overcome language learner problems, Shei (2006) proposes a CALL program to help students to develop their linguistic abilities and demonstrates, among other things, that computer-based grammar is helpful in generalizing from details and synthesizing concepts, or relating concepts to each other. Lee (2004) and Levy and Kennedy (2004) report that focus on grammar in Internet-based interactions is important, and computer-based instruction should balance between form and meaning, or linguistic fluency and accuracy. Felix (1999) notes that web-based grammar exercises offer opportunities for meaningful, contextualized work which can be carried out alone, in pairs or in groups. Schulze (1999) also observes that CALL grammar programs are useful to the user because they provide feedback about correct language structures. In a more recent study, Ware and O'Dowd (2008) have also demonstrated that students clearly favored an integration of language form into their computer-mediated learning.

In another study, Vanparys and Baten (1999) report that in the body of literature on learning strategies, there is still a need for more flexible courseware that enables users to work in pursuit of their goals on the basis of their learning styles. Collentine (2000) supports the study and says that CALL software containing user-behavior tracking technologies can provide important insights into the construction of grammatical knowledge. A number of studies have focused on computer-based grammar instruction under different treatments. For instance, Nagata (1998) presents

an experiment concerning the relative effectiveness of computer assisted comprehension practice and production practice on the learning of a second language. Robinson (1996) also used computer-based instruction to teach some language structures of English under two conditions: the rule-search subjects and the rule-instructed subjects.

Studies that have contrasted the effectiveness of computer-based grammar instruction and traditional grammar instruction to date seem to be quite limited compared to other language skills and components such as writing and communication. McEnery, Baker and Wilson (1995), Nutta (1998), Robinson (1996), and Torlakovic and Deugo (2004) report that computer based instruction is more functional than traditional instruction for teaching language structures and rules. In a more recent study, Abuseileek and Rababah (2007) conclude that there are significant differences in favor of the computer-based grammar instructional method over conventional instruction. However, Chen (2006) presents different findings. He demonstrates that there are no statistical difference between the experimental group and the control group that received non-computer-based learning.

1.2 Research in inductive vs. deductive instruction

Inductive and deductive approaches have been used in teaching grammar, and both have been found useful. Szkolne (2005) suggests that inductive grammar teaching is highly beneficial in that it involves students in the process of knowledge construction, encouraging them to form hypotheses that are to be tested. However, it can lead to incorrect conclusions which need to be verified and corrected. If grammar is not taught explicitly, the learner is likely to make false assumptions about the foreign language (FL) on the basis of limited data. In support of this view, Hall (1998) believes that the finer points of FL grammar are difficult to pick up implicitly. They may be accessible to exploratory learning with the help of a large corpus, but usually the simplest way is to teach these structures explicitly. Szkolne (2005) adds that the deductive approach to grammar teaching is less conducive to fostering learner autonomy, yet it may be much more effective in the contexts where learners' background knowledge or time available favor quick, efficient and correct teacher delivery of grammar information. Students are also motivated to learn grammar and gain satisfaction from it. Donmall (1996: 59) puts it even more strongly, "Finding out about language and its grammar can be sheer fun". The two methods of teaching and learning do not, of course, rule each other out. On the contrary, we can expect the best results from a combination of the two approaches as Corder (1988: 133) explains:

What little we know about the psychological processes of second language learning, either from theory or from practical experience, suggests that a combination of induction and deduction produces the best results.

Studies that have contrasted the effectiveness of inductive and deductive instruction showed there is conflicting evidence as to the effectiveness of these two instructional approaches. Herron and Tomasello (1992) detected an overall advantage for inductive instruction, and DeKeyser (1995) and Robinson (1996) found that the subjects in the deductive group outperformed the inductive one. Abraham (1985), Rosa and O'Neill (1999), and Shaffer (1989) uncovered no significant difference between

the two approaches, but reported a trend in favor of the inductive approach. In more recent research, Erlam (2003) revealed a significant advantage for the deductive instruction group. In the most recent study, however, Borg and Burns (2008) examined the beliefs and practices about the integration of grammar in a study which consisted of 176 English language teachers from 18 countries. They expressed strong beliefs in the need to avoid teaching grammar in isolation and report high levels of integration of grammar in their practices including implicit instruction.

Inductive instruction has proceeded in different ways. In one study (Seliger, 1975), inductive instruction involved presentation of the grammatical rule by the teacher at the end of the lesson; in other studies, students were to look for the rule (Robinson, 1996; Rosa & O'Neil, 1999) or verbalize it (Shaffer, 1989), but it was never verbalized by the teacher. In two studies (Abraham, 1985; Herron & Tomasello, 1992), students received sentences containing the target structure, but did not receive instructions to look for a rule or pattern. In this study, induction is defined as a process that involves exposing the language learner to samples of language use, from which will emerge patterns and generalizations (Decoo, 1996; Gollin, 1998), and learners are not taught rules directly but are left to infer rules from their experience of using language (Richards *et al.*, 1985). Deductive instruction, in the aforementioned studies, has involved explicit rule presentation by the teacher at the beginning of the lesson. In this study, deduction is defined as a process in which learners are taught rules by the teacher (Norris & Ortega, 2000) and given specific information about language at the beginning of the lesson before they engage in language practice. Then, they apply these rules when they use language.

To summarize, research to date that has investigated the effectiveness of deductive and inductive instructional approaches has produced conflicting evidence as to the relative effectiveness of these two teaching approaches on the learning of the target language structures. As far as the literature review is concerned, there have been very few comparative studies that investigated the effectiveness of both approaches. Also, none of the studies has compared the deductive and inductive approaches in traditional 'Talk and Chalk' and computerized settings. Thus, it is the aim of this study to fill this research gap.

2 The study

This study aims at investigating the effect of an Internet-based course on students' ability in the computer-based learning of sentence types inductively and deductively. The questions addressed by this study were:

- (1) Does the overall improvement of the experimental group from the pre-test to the post-test differ from the improvement of the control group?
- (2) Do learners who receive computer-based learning perform significantly better than those with non-computer-based learning on measures of sentence type learning in the activity type?
- (3) Do learners who are taught inductively perform significantly better than those who are taught deductively on measures of sentence type learning?
- (4) Do learners who receive computer-based learning perform significantly better than those with non-computer-based learning on measures of sentence types?

3 Method

3.1 Setting

This study was conducted at the Department of European Languages (English Language Program), College of Languages and Translation, King Saud University, a leading English teaching university in Riyadh, Saudi Arabia. The department offers undergraduate and graduate programs in English language and applied linguistics and theoretical linguistics. It aims at promoting cross-cultural understanding and common humanitarian values. The department has several e-learning language laboratories equipped with the most up-to-date hardware and software where this study was conducted. They are also equipped with an e-learning system used in learning English. Each lab has 36 multimedia personal computers with an Internet connection and web browser software. Instructors use either ready-made commercial material or develop their activities which are designed to consolidate students' English language abilities.

3.2 Participants

A total of 79 adult EFL undergraduates, enrolled in four sections of the English language education course of Basic Language Skills, participated in this study. The students participated in this study as a regular class activity. To keep the participants as homogeneous as possible, data for seven participants of the 79 were eliminated from the study because they did not study English as regular students in the BA program. Their mean estimated GPA at beginner English language courses at the time of testing was 2.67; 4.0 _ A, 3.0 _ B, 2.0 _ C, 1.0 _ D, 0.0 _ F, indicating that this was a sample of limited English proficiency. They ranged in age from 18–21, with a mean age of 19 years. All participants were males due to cultural values which support segregation in classes between males and females in Saudi Arabia. All of them were Saudi except three (Indian, Syrian and Palestinian), and all (except one) spoke Arabic as their first language and were learners of English as a foreign language which reflected the cultural background of the Saudi educational system that focuses at qualifying the national students. Mean self-reported English score in the English Department Placement Test (similar to TOEFL Exam) for the group was 65, with a minimum of 60 and a maximum of 81 points. Possible scores of the English Department Placement Test range from 0–100. Each of the participants had used the computer before with an average of six years. Of the total number of the participants, only three had been to a country where English is spoken natively, such as the United States and the United Kingdom, with a medium length of stay of about two months, which may indicate that this was a sample of limited English proficiency.

3.3 Design

A pre-test/post-test design (between-subject) was used to investigate the effect of two factors: method (computer-based learning vs. non-computer-based learning) and technique (induction vs. deduction) on the students' learning of sentence types. In this 2*2 design, the participants were randomly assigned by the university to one of four treatments of grammar: (1) with computer-based learning inductively,

Table 1 Mean and Standard Deviations on the pre-test and post-test in sentence types

Group	Pre-test		Post-test		Sig.
	Mean (Out of 40)	SD**	Mean (Out of 40)	SD**	
1	16.11	1.21	27.88	4.97	.000*
2	16.37	3.64	33.06	2.11	.000*
3	16.00	1.49	21.77	2.77	.000*
4	15.80	1.56	25.47	4.00	.000*

*The results are significant at the $p < .05$ level.

**SD = Standard Deviation.

(2) with computer-based learning deductively, (3) with non-computer-based learning inductively, and (4) with non-computer-based learning deductively. Each student completed a pre-treatment grammar test to determine his knowledge of the sentence types in this study. All students were found to have low prior knowledge of grammar. The participants in these four groups did not differ in their performance on the grammar pre-test (see Table 1). It should be stressed that students are distributed to sections by the university and the instructor cannot change this. Therefore, a further eleven students were eliminated from the study to keep the groups as equal as possible in the pre-test.

3.4 Material

Participants in this grammar course are thoroughly trained in basic sentence types. With this aim in mind, and when dealing with sentence structure, the instructor has to proceed in subtle gradations, moving from the simple to the complex. However, since the study of sentence structure is inseparable from any basic composition course, such study is profound rather than shallow, preparing the student for the next writing course in level two. Among other things, the course involves parts of speech, tenses, subject-verb agreement, types of sentences (including simple, compound, complex, and compound complex), various types of modifiers, as well as transitional expressions. Emphasis is also laid on the extensive use of exercises and sentence patterns and types in the classroom. By the end of the course, students are expected to use well-formed sentences of various patterns and types, and recognize parts of speech, tenses, and sentence structures in English.

Participants in the experimental and control groups used Betty Schramper Azar's (1992) *Fundamentals of English Grammar*, 3rd edition. However, the researcher produced a digital file which includes training material about sentence types. It was uploaded to the university website, <http://sites.ksu.edu.sa/websites/moodle>.

However, the material in this study was restricted to the four basic sentence types. Sentences are classified into four types according to the number and kind of clauses which they contain. The instruction focused exclusively on these sentence types and their components during four weeks of instruction, though all students were enrolled in a listening and speaking course in English during these four weeks. They are

represented in the following activities (structures were not included in the induction version):

Activity 1: The Simple Sentence (a sentence with only one independent clause and may contain one or more phrases, but does not contain dependent clauses)

Students should be able to recognize and produce the following sentence type:

Subject + Verb ... (e.g., *He swam* and *I met him yesterday*).

Activity 2: The Compound Sentence (a sentence made up of two or more independent clauses, but not containing dependent clauses)

Students should be able to recognize and produce the following sentence type:

Subject + Verb ..., Coordinator + Subject + Verb ... (e.g., *I am hungry, and he is thirsty*).

Activity 3: The Complex Sentence (a sentence which contains one dependent clause and one or more independent clauses)

Students should be able to recognize and produce the following sentence type:

Subordinator + Subject + Verb ..., Subject + Verb ... (e.g., *After they had lived in London, they travelled to Paris*).

Activity 4: The Compound Complex Sentence (a sentence which has two or more independent clauses, at least one of which is complex).

Students should be able to recognize and produce the following sentence type:

Subordinator + Subject + Verb ..., Subject + Verb ..., Coordinator + Subject + Verb ... (e.g., *When George first met Suzan, she was a student, but she is now a teacher*).

3.5 Instructional software and treatment

In this study, *Moodle* was used for teaching the two experimental groups. It is a free open source e-learning system for producing Internet-based courses and websites, which is primarily developed in *Linux* using *Apache*, *MySQL* and *PHP* (also sometimes known as the *LAMP* platform). It is also regularly used with *PostgreSQL* and on *Windows XP*, *Mac OS X* and *Netware 6* operating systems. It was downloaded from the free site www.moodle.org and uploaded to the university site, <http://sites.ksu.edu.sa/websites/moodle>. It has the following features and modules that make it practical, effective and easy to use: Overall Design which enables the administrator to tailor effective online courses, Site Management by a defined user while setting up, User Management to control the creation and modification of courses, Course Management to enable the teacher to have full control over the course activities, Assignment Module for receiving students' assignments and resending feedback about them, Chat Module for making synchronous text interaction, Choice Module which is used to vote on an issue, Forum Module, Quiz Module, Resource Module which supports display of an electronic content as *Word* and *PowerPoint*, Survey Module which analyses different activities in online classes, and Workshop Module for peer assessment of documents (see Figure 1).

For the purposes of this study, the researcher designed a two-version online activity; one deductive and the other inductive which did not include rules and

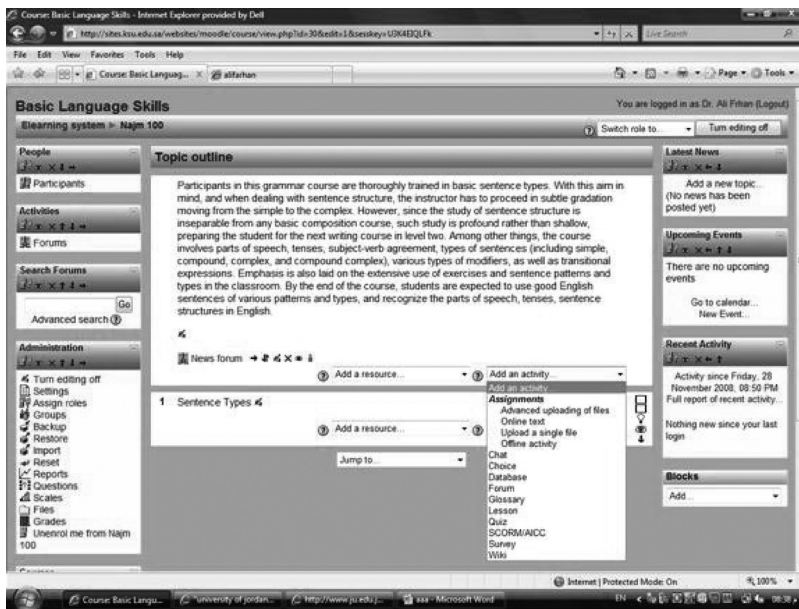


Fig. 1. A screenshot for the module of activities in Moodle

structures. Therefore, each individual student followed either an inductive or deductive route, and the students were allowed to move freely between different fragments of the material presented only in one version. The material was uploaded to the e-learning system of the university. It was designed in an interactive way which allows the student to navigate back and forward to receive the information according to his own pace. In the inductive version of the course, the learner is exposed to samples of language use, from which will emerge patterns and generalizations. Rules are not presented directly. However, learners are not left to infer rules from their experience of using language in the deduction version of the program. They are taught rules and given specific information about language. Then, they apply these rules when they use language. The deduction version involves rule explanation by a teacher at the beginning of a lesson before students engage in language practice.

Before the experiment, the researcher explained to the participants in the experimental groups what they should expect in the experiment, using a *PowerPoint* presentation. A password and ID were assigned to each of the participants to login throughout the course of the study. Each student was then asked to login, to be familiar with the software. A language instructor with advanced computer experience was chosen to teach the treatment groups. By broadcasting his screen to students' workstations, he exposed the language learner from the computer-based induction group to samples of language use, from which would emerge patterns and generalizations. He did not teach rules directly, but learners were left to infer rules from their experience of using language. On the other hand, learners in the computer-based deduction group were taught rules and given specific information about language. Then, they applied these rules when they used language. This involved rule explanation by the instructor at the beginning of the lesson before students engaged in language practice.

Students in the latter group navigated back and forward to check for pieces of information or feedback about certain aspects of sentence types. Each, therefore, could select the learning pace and the sequence of learning. Each of the subjects also used an easy-point click mouse function for answer selection and submission. The activities included small group discussion, role-plays, and discussions of assigned texts, information-gap and multiple-choice activities. Most discussions were based on questions posed by the instructor. Both groups were given the same activities, but they were presented differently, inductively or deductively. Participants in each of the experimental groups had access to either the inductive or the deductive copy of the material, while members of each of the control groups were allowed to have a traditional copy of the same material – either the inductive or the deductive copy.

3.6 Test

In order to answer the questions of the study, a test was designed for this study. It consisted of four major questions about the four sentence types. Each test contained ten points of two sections (recognition 5 and production 5). One grade was allocated for each point, so the total was out of 40. The recognition part included 4-multiple choice questions (see Example 1) while the production section involved using words in complete meaningful sentences (see Example 2).

Example 1: Choose the most suitable answer

- a. He bought a book me.
- b. He a book bought for me.
- c. He bought me a book.
- d. He me bought a book.

Example 2: Use each of the following pairs of verbs in a complete meaningful complex sentence to describe what you did yesterday:

(wake up – wash, drink – take, listen – enjoy, wear – go, study – write)

To ensure the test reliability, it was given to three colleagues, a native speaker and two non-native speakers who are specialists in applied linguistics. They were asked to validate the test in terms of suitability of rubrics, the aims of the course and content. They presented suggestions and comments, such as adding a production part of the questions, and their comments were taken into consideration.

In order to find the effect of the computer-based learning approach, all students took a pre-test during the first week of the study. They also took a post-test at the end of the study.

3.7 Procedures

The study was conducted with the following six steps:

- 1) An introductory lesson about CALL and computer-based grammar instruction.
- 2) Survey of personal information about age, gender, nationality, language, living in an English speaking country, and computer use.

- 3) Survey on prior knowledge of English proficiency (GPA) and level in grammar (the Department Placement Test – Grammar section only).
- 4) Pre-testing students in sentence types.
- 5) The lessons: 50-minutes sessions, three times weekly extended over a month.
- 6) Post-testing students in sentence types.

3.8 Data analysis

In this study, a pre-test/post-test design (between-subject) was used to investigate the effect of two factors: method (computer-based learning vs. non-computer-based learning) and technique (induction vs. deduction). The treatment conditions (with computer-based learning inductively, with computer-based learning deductively, with non-computer-based learning inductively, and with non-computer-based learning deductively) were the independent variables, scores on the pre- and post-tests being the dependent variables. To determine differences among groups regarding their scores, mean scores and standard deviations of the results of the two experimental groups and the two control groups on pre- and post-tests were calculated using ANCOVA. To find out whether those findings were significant, *post hoc* analyses using Scheffe were employed. Gain scores between pre- and post-tests, and computer-based learning or non-computer-based learning were also compared. All analyses were conducted using *SPSS*, version 11.5.

4 Results and discussion

The first research question was *Does the overall improvement of the experimental group from the pre-test to the post-test differ from the improvement of the control group?* Table 1 shows the four groups' achievement on pre- and post-test in sentence types.

According to the findings in the table above, there has been a large improvement in the participants' achievement on the post-test in sentence types. The achievement of the four groups in the post-test significantly outperformed that of the pre-test at the $p < .05$ level. This seems to be due to the method (computer-based learning vs. non-computer-based learning) and technique (induction vs. deduction) of instruction. These findings also suggest that the learners' knowledge of sentence types has improved, whether they received computer-based learning or non-computer-based learning inductively or deductively.

It can be concluded that the two variables caused the gain. They might have both hindered it equally and the gain has to be attributed to another variable. The gain was significant, and that makes it meaningful to check for significant differences between the achievement of all groups for every variable, method (computer-based learning vs. non-computer-based learning), and technique (induction vs. deduction). This is discussed in further detail in the following second, third and fourth questions.

The second question posed earlier in this study was *Do learners who receive computer-based learning perform significantly better than those with non-computer-based learning on measures of sentence type learning?* Results are presented in Table 2.

The results in Table 2 indicate that groups that receive computerized instruction (mean score = 30.39) outperformed the other groups taught traditionally (mean

Table 2 Mean and Standard Deviations by method on the post-test in sentence types

Method	Group	N	Mean (Out of 40)	SD	F	Sig.
Computer-based learning	1 + 2	33	30.39	4.62	43.28	.000*
Non-computer-based learning	3 + 4	39	23.76	3.92		

*The results are significant at the $p < .05$ level.

score = 23.76). It also shows there was a significant difference in favor of the computer-based learning method ($F = 43.28$, $p < .05$ level) as compared to non-computer-based learning. These differences suggest that when learners have access to the computer in language instruction, they seem to learn more than when they receive traditional instruction. The findings of the study also indicate that EFL learners gain more from computer-based learning than non-computer-based learning. The results suggest that the system can have beneficial effects for learners who have access to it.

This finding can be explained based on the assumption that computer-based learning enables the learner to have feedback about any related point whenever s/he likes. The system can provide the user with feedback about any point by just a click of a mouse. The type of feedback the system provides can be available anytime and anywhere. The system, thus, can be considered as an extra 'tutor', always available to help the learner in a relaxed atmosphere, which is used in a sense different from traditional instruction. Segers and Verhoeven (2003) reported a positive effect of computer-based training, in that it can enhance learners' language abilities in an alternative and relatively teacher-independent environment. Moreover, the material in the system is arranged in an easy to access way whenever and wherever needed. Kitade (2008) found that computer-based communication enables language learners to actively engage in a wider range of interactions because they are both place-independent and time-independent. In computer-based instruction, learners may have the opportunity to have feedback through using the bulk of information available on the system which is always available in a non-threatening atmosphere, and whenever the user wants it, and each learner can work at his own pace (AbuSeileek, 2007).

This finding can also be attributed to the fact that when using computer-based learning the student is not embarrassed to ask about a point he does not know using computer-based learning. This is not available in traditional instruction where the student may be shy or afraid to ask the instructor in front of other classmates. Many studies (Beauvois, 1992; Kelm, 1992; Kern, 1995; Sullivan & Pratt, 1996; Warschauer, 2000) found that computer-based instruction, as compared to face-to-face learning, has an equalizing effect on the quantity and quality of participation because participants feel less anxious or shy. Fitze (2006) and Warschauer (1996) also noted that shyness, a lack of confidence and a feeling of discomfort were related to students' participation more in face-to-face traditional discussions, and less in computer-based learning. Hata (2003) observed that some learners are shy, passive and afraid to speak in foreign language classes. That is simply because they are worried in face-to-face learning. AbuSeileek (2007) also found that computer-based instruction is distinguished from conventional education by encouraging students to participate actively in communication and provides learners with opportunities to interact in a non-threatening atmosphere.

Table 3 Mean and Standard Deviations by technique on the post-test in sentence type

Technique	Group	N	Mean (Out of 40)	SD	F	Sig.
Induction	1 + 3	35	24.74	5.00	11.50	.001*
Deduction	2 + 4	37	28.75	5.02		

*The results are significant at the $p < .05$ level.

The third question posed in this study is: *Do learners who are taught inductively perform significantly better than those who are taught deductively on measures of sentence type learning?* Table 3 presents mean scores and standard deviations for technique (induction vs. deduction) for all groups on the sentence type post-test.

The results show the main effect of technique, indicating a significant advantage of deduction training as compared to induction training; mean score = 28.75 and 24.74 respectively ($F = 11.50$, $p < .05$ level). It can be inferred here that EFL learners are more likely to make more progress when they are taught sentence types deductively than inductively.

According to Table 3, the sentence type post-test showed a positive effect of the deductive technique on the achievement of all groups. In deductive instruction, rules and structures are presented explicitly by the instructor at the beginning of a lesson before students engage in language practice, and then they apply these rules when they use language. This seems to be more suitable in this study for teaching complex structures such as the complex sentence and compound complex sentence types. This finding also lends support to many of the previous studies. For example, Hall (1998) reported that it is difficult for learners to learn grammar implicitly, and this may lead him/her to make false assumptions. This finding also seems to be in line with Szkolne (2005) who noted that the deductive approach to grammar teaching may be more effective in the contexts where learners' background knowledge or time available favor quick, efficient and correct teacher delivery of grammar information. It is also in agreement with DeKeyser (1995), Erlam (2003) and Robinson (1996) who found that the subjects in the deductive group outperformed the inductive one.

However, it is also possible that the results were skewed because of the modus of testing which contains a multiple-choice type of question, and students may get an item in the test wrong because they did not understand the vocabulary or were distracted by the content of the example. Perhaps students favored deduction or computer-based learning. Other minor variables could, and probably did have an influence, like the time of day when each class took place, minor modifications in the instruction, classroom atmosphere, group dynamics, despite the fact that all groups were taught by the same instructor, at the same time (in the morning) and in the same classroom.

The final question of this study was *Do learners who receive computer-based learning perform significantly better than those with non-computer-based learning on measures of sentence types?* To answer the question, the Descriptive Statistics resulting from description of the properties of variables included in the study, means and standard deviations and ANCOVA analysis were made for the results of all students who participated in this study, as presented in Table 4.

Table 4 Mean and Standard Deviation and ANCOVA analysis on post-test in sentence types

Sentence type	Method	Technique						F.	Sig.
		Induction			Deduction				
		Mean (out of 10)	SD		Mean (out of 10)	SD			
Simple	Computer-based learning	6.88	2.23		7.62	1.20	1.94	.131	
	Non-computer-based learning	7.94	.802		7.80	1.12			
Compound	Computer-based learning	8.58	1.37		7.68	1.13	1.80	.154	
	Non-computer-based learning	8.11	1.02		8.19	.928			
Complex	Computer-based learning	6.47	2.57		8.937	8.93	24.02	.000*	
	Non-computer-based learning	3.00	2.22		5.00	2.25			
Compound complex	Computer-based learning	5.94	1.85		8.81	.98	33.57	.000*	
	Non-computer-based learning	2.72	1.84		4.47	2.24			

*The results are significant at the $p < .05$ level.

Table 5 Scheffe post hoc test (multiple comparisons) on sentence type post-test

Group	1		2		3		4	
	Mean difference	Sig.	Mean difference	Sig.	Mean difference	Sig.	Mean difference	Sig.
1			-5.1801*	.002	6.1046*	.000	2.4062*	.266
2	5.1801*	.002			11.2847*	.517	7.5863*	.000
3	-6.1046*	.000	-7.5863*	.517			-3.6984*	.026
4	-2.4062*	.000	-6.017*	.000	3.6984*	.000		

*The mean difference is significant at the .05 level.

Table 4 reveals the findings of the four treatments of grammar: (1) with computer-based learning inductively (mean score = 6.88), (2) with computer-based learning deductively (mean score = 7.62), (3) with non-computer-based learning inductively (mean score = 7.94), and (4) with non-computer-based learning deductively (mean score = 7.80) in the simple sentence. These findings were insignificant for the method of instruction (computer-based vs. non-computer-based) at the $p < .05$ level ($F = 1.94$). The table also indicates that the computer-based inductive group (mean score = 8.58) outperformed the other groups, namely computer-based deductive, non-computer-based inductive, and non-computer-based deductive group in the compound sentence (mean score = 7.68, 8.11, and 8.19 respectively). However, the findings were insignificant at the $p < .05$ level. This may indicate that neither method nor technique of instruction seems to have an effect on learners' achievement in these sentence types (simple and compound).

In the complex sentence, however, computer-based learning (both inductive and deductive) (mean score = 6.47 and 8.93) achieved more significant gains than non-computer-based learning inductively (mean score = 3.00) and deductively (mean score = 5.00) at the $p < .05$ level. In the compound complex sentence, the computer-based deductive group had the highest significant mean score (8.81), followed by the computer-based inductive group, the non-computer-based deductive group, and the non-computer-based inductive group (mean score = 5.94, 4.47, and 2.72 respectively) at the $p < .05$ level. Out of these four groups, the computer-based deductive group had the highest mean and the lowest standard deviation ($SD = .98$), indicating that computer-based deductive instruction is the most beneficial instructional approach for most of the students included in this study.

To find the differences between the four groups' achievement in sentence types, a Scheffe post hoc analysis was run. The results are stated in Table 5.

Results in Table 5 indicate significant differences between students' performance in favor of computer-based learning (between groups 1 and 3; and between groups 2 and 4) and deduction technique (between groups 2 and 4; and between groups 1 and 3). However, there was no significant effect between the computer-based induction instruction (group 1) and the non-computer-based deduction group (group 4); and between the achievement of the computer-based deduction group (group 2) and the non-computer-based induction learning (group 3).

The findings in Table 4 and Table 5 show that neither method (computer-based vs. non-computer-based) nor technique (induction vs. deduction) of instruction has an effect on the four groups' achievement in simple and compound sentence instruction. That is, EFL learners have the same gains whether they received computer-based learning or non-computer-based learning inductively or deductively, despite the fact that all groups studied each sentence type separately then all sentence types were taught together and received the same treatment. This may be attributed to the following four reasons. Firstly, the simple sentence and the compound sentence are the easiest sentence types in English, so there may be no need to exert more effort on teaching them using different methods or techniques. Secondly, learners in this study seem to have mastered them easily although they had limited English proficiency and are at the pre-intermediate level. Thirdly, students might have mastered the sentence structures through exposure to sentence types in English previously at high school. Finally, the structure of the simple sentence and the compound sentence are the most prevailing sentence structures in the sample students' native language, Arabic, which may make it familiar and easy to acquire. Unlike other sentence types (the complex sentence and compound complex sentence) which are more elaborate and complex and have extra uses that do not exist in the native language, the simple sentence and compound sentence structure in both Arabic and English have many similarities in structure and use.

However, induction seems to be more favored for teaching the simple sentence (the non-computer-based learning group) and the compound sentence (the computer-based learning group). Though these findings are insignificant, the groups that received induction instruction had higher mean scores. In induction instruction, learners are exposed to samples of language use, from which will emerge patterns and generalizations and learners are not taught rules directly, but left to infer rules from their experience of using the language. There are other studies which support using induction techniques for grammar instruction. For instance, Shaffer (1989) reported that there is a trend in favor of the inductive approach over deductive instruction. In more recent research, Herron and Tomasello (1992) detected an overall advantage in inductive instruction. To conclude, it seems that the two techniques of teaching and learning, induction and deduction, do not rule each other out. Thus, a new manner of enhancing grammar learning has emerged, based on the level of language structure complexity and the learners' linguistic level. That is, the best results can be obtained from a combination of the two approaches. For learners with limited language proficiency, deduction instruction is best used for teaching complex structures such as the compound complex sentence, while both induction and deduction are appropriate for simple structures like the simple and compound sentence.

5 Conclusion

It should be noted that recognition (multiple-choice) and production (using words in sentences) types of test were used in this study. However, the results are presented jointly because measuring production and recognition abilities is beyond the scope of this study. Although the pre-test/post-test method was used in this study, the results are only valid for the limited instruction of sentence types and their components, not

for any other language structures. The results are also only valid for male students because the study was conducted exclusively on males due to cultural constraints which support segregation in classes between males and females in Saudi Arabia.

More studies are needed to investigate the effect of using sub-techniques such as the initial rule-oriented approach (involves initial presentation of explicit rules followed by illustrative examples) and the structure-guessing approach (involves explicit presentation of rules in response to structure-guessing exercises). There is also a need for devising more studies on bigger samples and more grammar aspects in order to consolidate/refute the findings of this study over longer periods of time, using different activities with samples of learners of different linguistic abilities.

The results of this study bring us a step closer to understanding the methods (computer-based learning vs. non-computer-based learning) and techniques (induction vs. deduction) by which EFL learners learn some language structures. It also shows a new manner of enhancing grammar learning based on the level of language structure complexity, i.e., simple and complex grammar structures and learners' linguistic level. For simple grammar structures such as the simple sentence, with learners of limited language level, it can be concluded that using the computer-based or the non-computer-based learning method seems to have no or little effect on learners' achievement in sentence types. However, it can also be inferred that the computer-based method might be functional for more complex and elaborate structures, like the complex sentence and compound complex sentence, which makes it easy for students to induce language forms and patterns from samples of language they are already exposed to. Moreover, more complicated grammar structures need to be taught by means of the deductive technique where rules and structures are presented explicitly before students practise language. On the other hand, neither of the inductive and deductive techniques was found to be more functional with simple grammar structures such as the simple sentence.

Overall, in this study technology turned out to be an important factor in shaping grammar learning. This is an important variable because it is very useful whether used alone or with an inductive or a deductive technique. Its importance stems from the fact that computer-based learning offers opportunities for promoting self-learning and a student-centered approach. The student who acts as a receiver of information sent by the instructor in traditional contexts may become a leader in situations involving the use of technology as a tool in language learning. In our sample students, this change was accompanied by switching to **using** English rather than simply receiving it. In this situation, students also turned out to be explorers of language forms and their use in different situations, resulting in a more balanced relationship between the structure and its use.

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