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The Effects of Cognitively Complex Task on Fluency, Accuracy and Complexity of L2 Learners' Written Performance

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ABSTRACT

Cognitive complexity of task is one of the factors which influence L2 learners' written performance. Although there have been a lot of studies in the field of task-based language teaching, a gap was discovered in the literature on the effects of cognitively complex task on L2 learners' written performance. This pilot study was conducted to explore the effects of cognitive complexity of task on L2 learners' written performance in the case of accuracy, complexity and fluency. This research was conducted by seven EFL students. In order to explore the effects of cognitively complex task on L2 learners' written production, first participants were given a simple version of narrative task to write an essay. After one week the same participants were given complex version of the narrative task. Then the data was submitted to statistic means including one- way ANOVA. The results show that cognitively complex task improves fluency of participants of this study.

Key Words: Task-based Language Teaching, Task, Task Complexity.

Introduction

Second language acquisition researchers, curriculum developers, teacher trainers and language teachers have been interested in utilizing task-based language teaching (TBLT) all over the world in the past 20 years. To a great extent, it was developed in reaction to empirical account of teacher-centred, form-oriented second language classroom practice (Long& Norris, 2000). TBLT presents the notion of "task" as a basic element of planning and teaching. Therefore, it is vital to know what a 'task' exactly consists of. Tasks have been defined in different ways. Willis (1996) defines task as an activity where learners use the target language for a communicative purpose in order to achieve an outcome. In this definition, the concept of meaning is included in 'outcome'. Similarly for Nunan (2006) tasks have a non-linguistic outcome. He defines task as:

> A piece of classroom work that involves learners in comprehending, producing or interacting in the target language while their attention is focused on mobilizing their grammatical knowledge in order to express meaning, and in which the intention is to convey meaning rather than to manipulate form. The task should also have a sense of completeness, being able to stand alone as a communicative act in its own right with a beginning, middle and an end (p.17).

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Performing a task will be affected by a number of factors, such as the cognitive complexity of the task, the conditions under which the task has to be performed (task format, participants involved, oral versus written mode) and individual differences such as attitude, motivation, anxiety, working memory. (Wickens 2007). Two cognitive- interactional models which much of the experimental studies in task-based language teaching (TBLT) and learning have been inspired are: Robinson's (2001, 2011) Cognition Hypothesis and Skehan's (1998, 2009) Trade-Off Hypothesis (also called Limited Attentional Capacity Model) which are the main concern of this study. The main attention of both models is to how characteristic of task can affect processes and outcomes.

Only a few researches have studied the effects of cognitive complexity on written performance of L2 learners (Kuiken, Mos & Vedder 2005, Kuiken & Vedder 2007). In this study we tried to explore the effects of cognitive complex task on seven L2 learners' written production. We investigated if they would be more accurate, more complex or more fluent, as they were given cognitively complex task which demands more cognitive processes or simple task which demands fewer cognitive processes.

Kuiken & Vedder (2007) presented four main approaches in task-based research: psychological, interactional approach; sociocultural approach; structure-focused approach; and cognitive, information-theoretic approach. Among these models, Robinson (2001, 2003, 2005) and Skehan & Foster (1999, 2001) consider cognitive approach in their researches. The main focus of their studies is cognitive processes which are used by the learners as they complete the task. They explore how task complexity affects the L2 learners' written performance.

Robinson's Triadic Componential Framework (2001) distinguishes three task components which may affect linguistic performance: *task complexity*, *task conditions*, and *task difficulty*. This framework which is based on cognition hypothesis assumed that learners have unlimited attentional capacity and they can access numerous attentional resources simultaneously and complex tasks promote learner to detect more attentional source which will lead to higher syntactic complexity, lexical variation and accuracy. (Robinson ,2001) Thus, Robinson proposes that better performance will be enhanced by planning task complexity on the basis of resource-directing variables. Robinson (2001) defines task complexity as:

> Task complexity is the result of the attentional, memory, reasoning, and other information processing demands imposed by the structure of the task to the language learner. These differences in information processing demands, resulting from design characteristics, are relatively fixed and invariant (p.29).

According to Ishikawa (2006), this aspect of task complexity is reflected as cognitive nature and natural and fixed demands of pedagogic tasks can be characterized by each aspect of complex task. Therefore, teachers and syllabus designers can use them prior to task performance.

Robinson (2001, 2003, 2005) classified two dimensions of task complexity as : *resource-directing dimensions* which contain few/many elements, here-and-now /there-and-then, with/without reasoning demands and *resource-dispersing dimensions* which comprise with/without planning, single/dual task, with/without prior knowledge. Robinson claims that accuracy and complexity of learners will improve by increasing task complexity along resource-directing dimensions. However, it is said to have no effect on developing fluency.

On the other hand, Skehan and Foster (Skehan 1998, 2001, 2003; Skehan and Foster 1999, 2001), distinguish three dimensions of task complexity as: *code complexity, cognitive complexity and communicative stress*. *Code complexity* is concerned with the linguistic demands of the task which includes linguistic and lexical complexity. *Cognitive complexity* refers to task content and the structuring of task material consists of cognitive processing and cognitive familiarity. The third area, *communicative stress*, concerns performance condition including time pressure, modality, scale, stakes, and control.

Skehan (1998, 2001, 2003) and Skehan and Foster (1991, 2001) define task complexity as the extent of attention which learners can pay to the task as they perform it. Unlike Robinson cognition hypothesis, Skehan's Limited Attentional Capacity Model (Skehan, 1998; Skehan & Foster, 2001, 2005) assumes that human beings have a limited information processing capacity and that different components of language production and comprehension compete for such limited capacities. If we give attention to one area, we will lose giving attention to another area. A central choice in this regard is between attention to form and attention to meaning. Skehan (1998) suggests that learners' fluency, accuracy and complexity demand capacities, and that there is a trade-off between these developmental implications. It means that the learner cannot give full attention to these three aspects of language production simultaneously. The main statement of Limited Attentional Capacity Model is that a development in cognitively complex task will make learners to focus primarily on the content of the task, as a result, complexity and accuracy of task will be decreased.

EARLIAR RESEARCH ON TASK COMPLEXITY

When we go through earlier research conducted on task complexity, Yuan & Ellis, (2003) conducted a study on L2 learners' writing production. They investigated the effects of pre-task planning, on-line planning, and no-planning on accuracy, fluency, and complexity of Chinese Narration writings. They found that pre-task planning led to more fluent production and, on-line planning led to more accurate production. This result is on line with the results of study which was gained in the research of Kang (2005). Like Yuan & Ellis, (2003), Kang found that pre-task planning improve fluency and accuracy of written performance.

Likewise, Robinson (2001) conducted a research on the effects of task complexity on L2 learners' written production. He gave a simple map task to the participants in which they had to give direction well known route on the campus while the complex version of this task addressed an unknown and larger area of town. The results show that complex task increased participants' accuracy.

In the same way, Ishikawa (2006) studied the impacts of task complexity and language proficiency on L2 learners' written performance regarding here –and-now & there-and- then dimension and he found that task complexity with respect to here-and- now dimension increased the accuracy, fluency, and complexity of learners' written language production.

Similarly, Kuiken et al. (2005) and Kuiken and Vedder (2007) Kuiken and Vedder (2008) conducted a series of studies on L2 learners' written performance. They asked L2 learners of French and Italian to think about three simple and six complex task diverse conditions when deciding between five possible holiday destinations. They tried to explore the effects of task complexity on syntactic complexity, grammatical accuracy, and lexical complexity of L2 learners' written performance. Like Gilabert (2011) they found that cognitively complex tasks elicited a higher degree of accuracy

Likewise, Gilabert (2007) and Gilabert et al. (2009) conducted two other studies using Robinsons' map task. In the simple task participants had to give directions on a map with limited, obviously special features but the complex task presented more elements that also were more difficult to discriminate from each other. The results represented by Gilabert et al. show that complex tasks lead to a higher accuracy and lexical diversity than simple tasks.

Also, Hosseini &Rahimpour (2010) studied the impacts of task complexity on L2 learners' written performance on narrative pictorial tasks of here-and- now and there-and- then. They found that cognitively more demanding task (there-and- then) led to fluent written production on the other hand, no major impact of complex task in the case of accuracy and complexity were observed. The result of their study was on line with the findings of Ishikawa (2006) and Ong &Zhang (2010) which found that task complexity improve fluency of L2 learners' written performance, but their findings was in contrast with the findings of Gilabert et al. (2005, 2007, 2009) and Kuiken and Vedder (2001, 2003, 2007) and Robinson's (2001, 2003) which found that cognitively complex task improve accuracy of L2 learners' written performance.

Finally, based on Robinson's (2001, 2003) cognition hypothesis and Skehan's (1998) Limited Attention Capacity Model, Ong &Zhang (2010) conducted another study on the impacts of task complexity on accuracy, fluency and lexical complexity of 108 EFL students' writing production. Task complexity was manipulated using three factors of planning time, provision of ideas and macro-structure, and the availability of drafts. The results of the study showed that grater fluency gained through increasing complexity of task with respect to planning time but grater lexical complexity and any improvement in fluency gained through increasing task complexity due to complex provision of ideas & macro-structure. On the other hand, increasing task complexity through the availability of draft produced any significant differences in fluency, and lexical complexity.

RESEARCH QUESTIONS

The questions under investigation in this study are as the following:

1. Are there any significant differences between accuracy, complexity and fluency gained in simple tasks?
2. Are there any significant differences between accuracy, complexity and fluency gained in complex tasks?

METHOD OF THE STUDY

Participants

This study was conducted by seven students who were studying EFL at Language School and all of them were thirteen years old.

Procedures

First participants were given simple version of narrative task and they were asked to compose an essay according to the pictures in 40 minutes .After one week the same participants were given narrative task again but this time cognitively complex version of narrative task and they were asked to write an assay according to the pictures in 40 minutes. They were told that they could arrange the sequences of pictures as the like and they could look up any unknown words in the dictionary or asked the researcher. Then the data was submitted to statistic means including one- way ANOVA.

In this research accuracy was measured by calculating the number of error-free T-units. (Arent, 2003; Rahimpour, 2008).). T-unit is defined as "a finite clause together with any subordinate clauses dependent on it" (Bygate, 2001, p. 35). Following Ishikawa (2006) fluency was measured by the number of words per T-unit. Complexity involves measuring both lexical and syntactic complexity. Lexical complexity of the written text was not taken into account since the learners used dictionaries or asked the researcher any unknown words. However, syntactic complexity was measured according to the number of S-nodes per T-units. (Rahimpour & Hosseini, 2010; Gilabert, 2005; Robinson, 1995; Ishikawa, 2006).

FINDINGS

This study was conducted to explore the effects of task complexity on L2 learners' written performance. We investigated if they would be more accurate, more complex or more fluent, as they were given cognitively complex task which demands more cognitive processes or simple task which demands fewer cognitive processes. In order to answer research questions the data were submitted to statistical analysis including one-way ANOVA.

The first research question of this study was to explore the effects of using simple task on the fluency, accuracy and complexity of L2 learners' written performance. The results are presented in table 1 and table 2.

Table 1.Comparison of the means of complexity, accuracy and fluency of written performance in simple task

	N	Mean	Std. Deviation
Simple Task. FLU	7	45.86	10.415
Simple Task. ACCU	7	9.43	3.101
Simple Task.COM	7	16.71	5.794
Valid N (listwise)	7		

Table 1 shows the means score of complexity, accuracy and fluency of written performances of participants in simple task. As can be seen in the table the mean score of fluency is higher than accuracy and complexity. Thus, we expected an improvement in the fluency of participants by giving them simple narrative tasks.

Table 2.The results of inferential statistics of one-way ANOYA for complexity, accuracy and fluency of simple tasks

		Sum of Squares	df	Mean Square	F	Sig.
Simple Task .FLU	Between Groups	642.857	5	128.571	16.071	0.18
	Within Groups	8.000	1	8.000		
	Total	650.857	6			
Simple Task. ACCU	Between Groups	57.214	5	11.443	22.886	0.15
	Within Groups	.500	1	.500		

	Total	57.714	6			
Simple Task.COM	Between Groups	188.929	5	37.786	3.023	0.41
	Within Groups	12.500	1	12.500		
	Total	201.429	6			

However as can be seen in table 2, there are no significant differences between fluency, accuracy and complexity of written performance of participants in simple task since significant level of these variables (fluency 0.18, accuracy 0.15 and complexity 0.41) are higher than significant value (0.05). Therefore, it can be concluded that there are no major effects of simple task on the accuracy, fluency and complexity of participants' written performance.

The second research question of this study was to explore the effects of using complex task on the fluency, accuracy and complexity of L2 learners' written performance. The results are presented in table 3 and table 4.

Table 3. Comparison of the means of complexity, accuracy and fluency of written performance in complex task

	N	Mean	Std. Deviation
Complex Task. FLU	7	53.14	13.765
Complex Task. ACCU	7	8.86	4.914
Complex Task.COM	7	16.57	4.429
Valid N (listwise)	7		

Table 3 shows the means score of complexity, accuracy and fluency of written performances of participants in cognitively complex task. As can be seen in the table, the mean score of fluency is higher than accuracy and complexity. As a result, we estimated that there was a progress in the fluency of participants' written performance by utilizing complex task.

Table 4. The results of inferential statistics of one way ANOVA for complexity, accuracy and fluency of complex tasks

		Sum of Squares	df	Mean Square	F	Sig.
Complex Task .FLU	Between Groups	1022.107	3	340.702	8.907	**0.05**
	Within Groups	114.750	3	38.250		
	Total	1136.857	6			
Complex Task. ACCU	Between Groups	86.107	3	28.702	1.466	0.38
	Within Groups	58.750	3	19.583		
	Total	144.857	6			
Complex Task.COM	Between Groups	44.964	3	14.988	.618	0.64
	Within Groups	72.750	3	24.250		
	Total	117.714	6			

One way ANOVA was applied to explore any significant differences in the development of fluency, accuracy and complexity of participants' written performance by using cognitively complex task. As can be seen in the table, there is an important effect of using complex task on the development of fluency since significant level of fluency (0.05) is the same as significant value (0.05). Therefore, it is understood that complex task led to more fluent written production of participants of this study.
In order to enrich the results, samples of essays of one of the participant in both simple and complex task are presented as the following:

Simple Task

Once upon a time, a boy see a sea. They boy want to go swimming. But he comes and he lose his clothes. He comes to the city and he searches his clothes. And then he sea a print race. He was start running and he was the winner. He was very happy.

Complex Task

Sue and Tom are in the classroom but there are no teacher in the class. The students are fighting, crashing and laughing. They are spend a good time. There are a lot of noisy in the class. Su and Tom are looking at a poster. The tittle of the poster is "COME TO SUNNY BEACH". They are go to there. They go to the street and buy ice-cream. The weather is hot and sunny. They go to the bus station and get on the bus. but the bus crashed on a big stone. Tom call his father. He work in a zoo. They go to the boat with their father and they are come to SUNNY BEACH.

As can be seen in the essay, in the simple task he just tried to describe what was happening in the pictures. He just described the frames of the task step by step. The events were so clear that he just wrote a sentence to describe every frame. He did not add anything by his own which was not happening in the task. Thus, the first essay was short and brief. However, in the complex task, the frames of the task were not as easy as the simple task and he had to spend more time to think about the events and related the events to each other and narrated the story. He used his imagination and his creativity to connect the events to the next one. Therefore, he used more words to write the story and the fluency of his production improved. In addition, as he tried to convey the messages, he lost his concern on accuracy and complexity. As a result, as can be seen in two essays, he used more words in the complex task and his fluency was increased.

Besides, researcher conducted an interview with the participants of this study to know what they really thought about two tasks which were given to them. All the participants admitted that cognitively complex task was more difficult than simple task. They told that they had to think more about complex task and they spent more time discovering what was happening in the task and how they should narrate the story.

Researcher prepared number of questions and invited them to the class separately and asked them to talk about two tasks which were given to them. Meanwhile, researcher recorded students' views. They had interesting opinions about tasks, for example, one of the participants told that" I like complex task since it is more challenging and exciting and I use my imagination to narrate the story". Other participant told that complex task was better than simple task since we were free to add our own story to it as well. He told that in the simple version we did not use our inspiration to narrate the story, there was just the story ready there to be narrated and we should only follow the sequences to narrate it. In contrast in complex version, we could use our creativity and could change the sequencing of

events as we liked and we had so much freedom to narrate the story and it would be our own story at the end.

Thus as can be seen, all the participants of this study had agreed that complex task was more challenging and interesting and they thought deeply to discover the story and narrate it. As a result as was mentioned by and Skehan's (1998, 2009) Limited Attentional Capacity Model as the participants concerned on conveying meaning and tried to focus on the content of the task they lost accuracy and complexity in the exchange of fluency, as a result, complexity and accuracy of their performance decreased.

RESULTS AND DISCUSSION

This study was conducted to explore the effects simple task and cognitively complex task on L2 learners' written production. As the results of the data analysis on simple version of narrative task show, there were no significant effects of simple task on accuracy, fluency and complexity of written performance of participants of this study. Also the results of this study indicated that there were no major effects of complex task on accuracy and complexity of participants. On the other hand, an important effect of using complex task on the development of fluency was discovered in this study. Consequently, it was understood that complex task led to more fluent written production of participants of this study.

Considering the results of the data analysis of complex task in terms of complexity and accuracy, there were no significant differences between complex task and L2 learners' written performance in these two areas of language production. Therefore, the findings of this study regarding the effects of task complexity on accuracy and complexity are against the predictions of Cognition Hypothesis (Robinson, 2007) which claims that complex tasks improve learners' accuracy and complexity.

Regarding the results of data analysis, complex task has significant effects on the fluency of written performance of participants of this study. Therefore, findings of this study are supported by Skehan's Limited Attentional Capacity (Skehan, 1998; Skehan & Foster, 1999, 2001) which claims that increasing task complexity decreases learners' attentional capacity; consequently, they will prioritize their attention for one aspect of performance (accuracy, fluency, complexity) and this prioritization will act as a barrier which prevents improvement in the other areas.

Likewise, the results of this study are in line with the findings of Ishikawa (2006), Ong &Zhang (2010) and Hosseini &Rahimpour (2010) who found that task complexity improve fluency of L2 learners' written performance, but findings of this study are in contrast with the findings of Gilabert et al. (2005; 2007; 2009) and Kuiken and Vedder (2001;2003;2007) and Robinson's (2001, 2003) who found that cognitively complex task improves accuracy of L2 learners' written performance.

PEDAGOGICAL IMPLICATIONS

This study recommended numbers of pedagogical implications for SLA teachers. As was stated by Robinson (2007), task complexity can be used as an effective norm for grading pedagogical tasks in terms of their cognitive complexity. Consequently, the results of this study can be utilized for selecting, grading, and sequencing tasks. Furthermore, the findings of present study propose that

teachers should consider the cognitive abilities of their learners as well as the cognitive load of task that is on learners. Moreover, by discovering task complexity on the basis of learners' abilities, teachers can benefit from affective factors of language learning. Affective factors include such a thing as shyness, positive and negative language attitudes, constantly enthusiasm, anxiety and boredom. As was proposed by Krashen (1978) these affective factors can be considered as vital factors in second language learning success or failure. When learners encountered with a classroom tasks that are much higher than their level of skills, they may feel nervous and upset; when given tasks that are below their cognitive ability, they may feel bored but giving learners interesting tasks that are challenging and are within their cognitive capability is most likely to elicit better outcomes.

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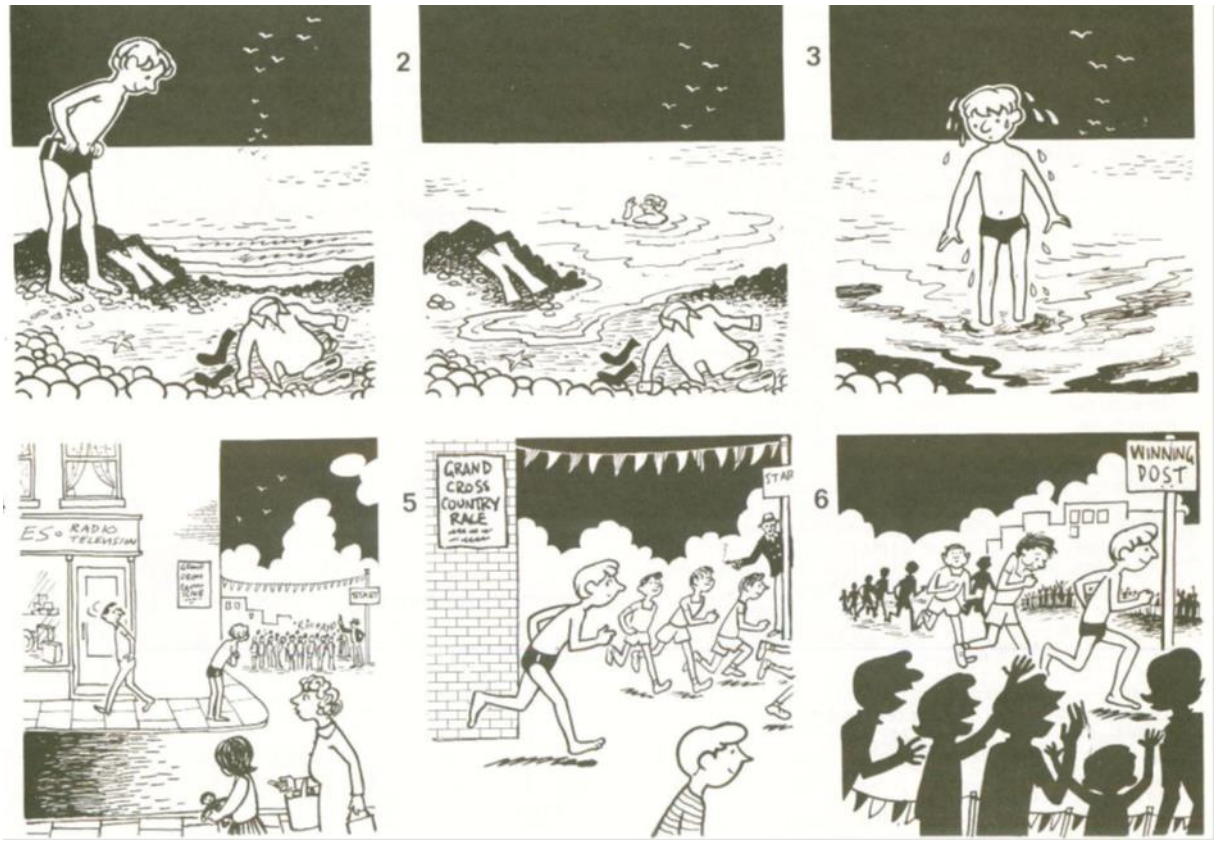
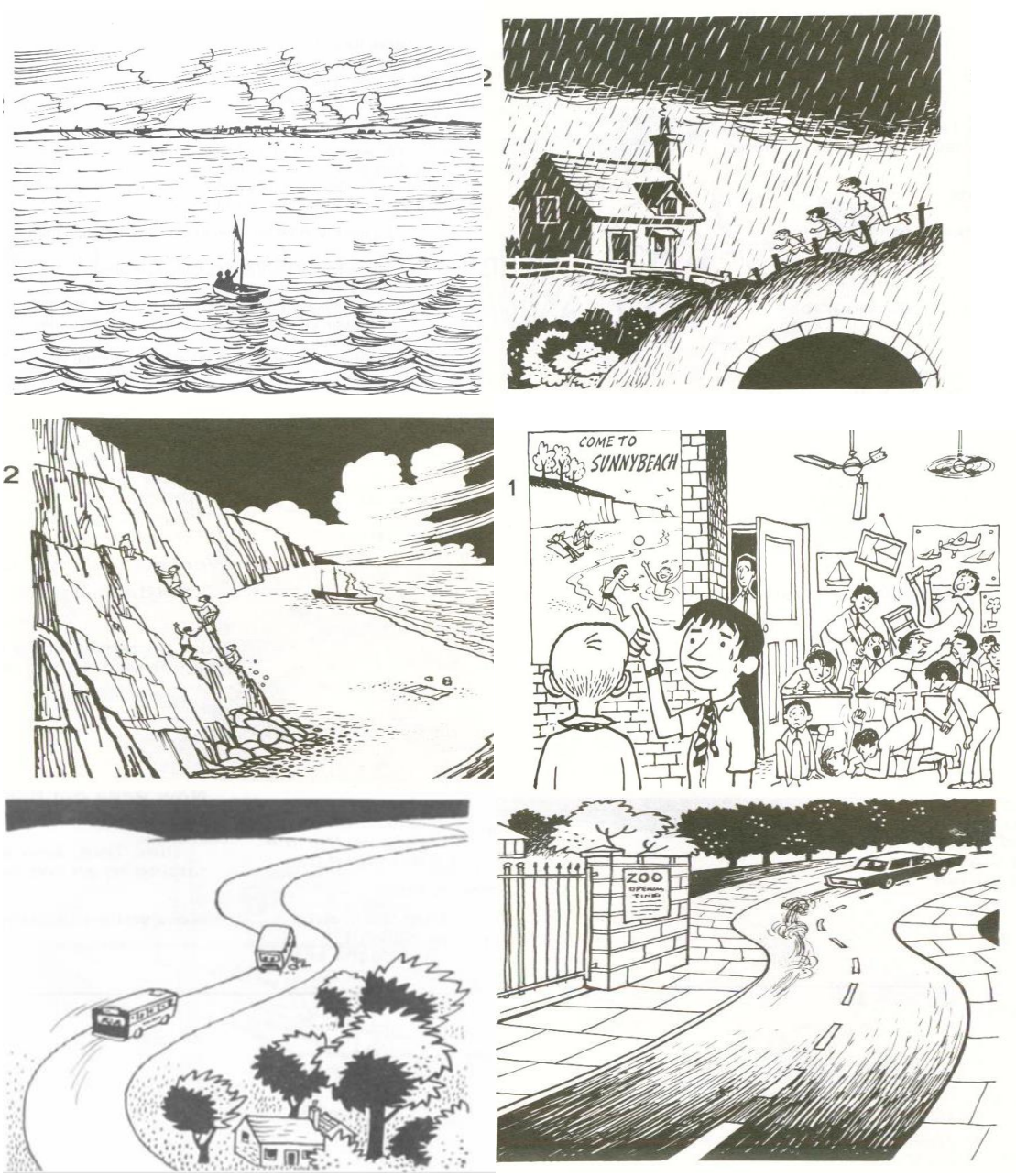
APPENDIX

Simple Version of Narrative Task



Adapted from "beginning composition thorough picture" by Heaton

Complex Version of Narrative Task



Adapted from "beginning composition thorough picture" by Heaton