TALKS: THE MOST CHALLENGING PART IN TOEFL LISTENING SECTION: A CASE STUDY

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ABSTRACT

This research investigates the major problems in TOEFL Listening Comprehension. The study is conducted to 1) identify the most difficult part in TOEFL Listening section, 2) explore factors affecting the difficulties, and 3) find out the students' strategies in coping with the difficulties. Twelve language students have participated in this research. Seven of them are the 7th semester S-1 students majoring English and five of them are the 5th semester D-3 students majoring Japanese. Data are collected through three instruments: test results, questionnaires, and interviews. The results of the study reveal that 1) the most difficult part of the listening section is Talks (Part C); 2) the factors affecting the difficulties cover analysis-leveled type of questions, infrequent vocabularies, speed delivery, and very academic talks; and 3) the popular strategy used is guessing.

KEYWORDS

TOEFL Listening, Difficulties, Affecting Factors, Strategies

INTRODUCTION

Background of the Study

The reliance on TOEFL (Test of English as a Foreign Language) for various assessment purposes of English proficiency has reached such a point that most universities and colleges both overseas and domestic ones TAKA A

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adopt this standardized test as a part of graduation requirements. One of the private universities in Bandung has accentuated the importance of this internationally acknowledged test through TOEFL-oriented English learning for students.

Of 790 students following TOEFL during the Academic Year 2004/2005, only 18 % got more than 450 TOEFL score, and the majority (82%) got less than 450 TOEFL score. After the result was explored, it was found that the average percentage of number-right score for the Listening section was still low (40%). This section was still deemed the challenging problem for the students.

Other particular sources extracted from the documents of two sessions of TOEFL held in June 2006 and May 2007 show that the parts of the Listening Comprehension section in the tests are different in degree of difficulties, as presented in the following Table 1.

Table 1: Average Percentage of Number-Right Scores in TOEFL Listening Section

AVERAGE PERCENTAGE OF NUMBER-RIGHT

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		SCORES	
	Short	Long	Talks
	Conversations	Conversations	(Part C: 12
	(Part A: 30 items)	(Part B: 8 items)	items)
June 2006	64	53	47
May 2007	62	57	51

Source: List of TOEFL Scores from the test held in June 2006 (followed by 80 test takers) and May 2007 (followed by 77 test takers)

Table 1 above shows that the test takers got the lowest score for Talks (Part C). Obviously, the percentage of the number-right scores of the three parts has down-ward trend: 64, 53, 47; and 62, 57, 51. According to the test results, the Talks section was considered to be the most difficult. Therefore, it was expected that in other contexts, the Talks section of TOEFL Listening Comprehension would also be deemed a challenging skill.

Research Questions and Objectives

Based on the background elaborated earlier, the research questions are formulated as follows:

- 1. Which part of TOEFL Listening Comprehension is considered to be the most difficult?
- 2. What factors affect the difficulties?
- 3. What strategies do the students employ to cope with the difficulties?

Related to the aforementioned research questions, this study was conducted to 1) identify the most difficult part in TOEFL Listening section and to explore the types of question presented in the part, 2) explore factors affecting the difficulties experienced by the students, and 3) find out whether or not the students' strategies are productive in answering questions for TOEFL Listening section.

Previous Research

Nissan (1996), in his research, tried to analyze factors affecting the difficulty of dialogue items in TOEFL Listening Comprehension. The results of the analysis indicate that there are five significant features: 1) the presence of infrequent oral vocabulary; 2) the sentence pattern of the utterances in the stimulus; 3) the presence of negatives in the stimulus; 4) the necessity of making an inference to answer the item; and 5) the roles of the speakers in the stimulus.

This empirical study only uncovered the factors that affect difficulties in the TOEFL Listening Comprehension Part A (short conversations) while Part B and Part C (long conversations and talks) were not discussed. It seems to be reasonable that the researcher focuses on Part A because this is the biggest part (60 %) in the TOEFL Listening Comprehension section.

THE NEW PARADIGM OF LISTENING: AN ACTIVE PROCESS OF ACCESSING INFORMATION

Listening, as a part of the language skills, is not an independently-separated skill. It is highly related to the other language skills, particularly to the speaking skill. In relation to the speaking skill, Brown (2001, p. 252) explained that there are eight characteristics of spoken English: 1)

clustering, 2) redundancy, 3) reduced form, 4) performance variables, 5) colloquial language, 6) rate of delivery, 7) stress, rhythm, and intonation, and 8) interaction. These characteristics are attributed to the natural and authentic spoken English.

As a matter of fact, spoken English presented in TOEFL Listening section seems to be scripted spoken English rather than natural and authentic English dialogue. Inspite of that, some of the eight aforementioned natures can be found in scripted spoken English, namely, 1) reduced forms, 2) rate of delivery, and 3) stress, rhythm, and intonation. These three natures were the causes of the difficulties the students encountered because such a receptive skill is a kind of active thinking activity in accessing any information.

Besides, the types of question posed may have been the contributing factors to the difficulties in TOEFL Listening. With respect to this, Nuttall (2005, pp. 184,187) proposed six types of questions: 1) questions of literal comprehension, 2) questions involving reinterpretation, 3) questions of inference, 4) questions of evaluation, 5) questions of personal response, and 6) questions concerned with how writers say what they mean. Nuttall's notion is relevant to Bloom's taxonomy (1956) in terms of cognitive domain: knowledge, comprehension, application, analysis, synthesis, and evaluation. However, only three of the six types above are employed in TOEFL Listening test, namely questions involving: literal comprehension (knowledge), reinterpretation (comprehension), and inference (analysis).

Related to listening as an information-accessing process, Barnes (1984), Nagle and Sanders (1986) as cited in Young (1997), state that listening is no longer perceived to be a passive process of information. Recent theories, still in Young (1997), suggest that listening is an active process rather than a passive process of aural stimuli. Listeners construct meaning from the oral input by drawing upon their prior knowledge of the world and of the target language. In line with this, Hadley (2001) points out that listening is not a passive skill; rather, it is a reactive skill for it places many demands involving the process of receiving, attending to and assigning meaning to aural stimuli.

This paradigm shift can encourage researchers to redefine what listening is. Howatt and Dakin as cited in Sacricoban (1999) and Mohammed

(2005) define listening as the ability to identify and understand speech involving identifying and understanding a speaker's accent or pronunciation, grammar, vocabulary, and meaning. Thus listeners are expected to comprehend spoken language. Further, Rost (2002, pp.1-3), views listening from the four perspectives: 1) receptive, 2) constructive, 3) collaborative, and 4) transformative. These perspectives emphasize that listening is a process involving a continuum of active process which is under the control of the listener.

The first two perspectives: receptive and constructive, have high relevance to the topic under discussion--TOEFL Listening Comprehension. Based on the two perspectives, listening is perceived as the activities for receiving, constructing, and representing the meaning of what the speaker actually says.

Listening, as aforementioned, is a continuum of active process which is under the control of the listener. In relation to this process, there are two types of processing information through listening, namely bottom-up process and top-down process.

Bottom-up process is a kind of strategy for processing detailed information including listening for specific details, recognizing cognates, and recognizing word-order patterns. According to Nunan (2003), bottom-up process is the process that exhausts linguistic capabilities to access information by using the component parts: vocabularies, grammar, and the like. The benefit for this process, in relation to TOEFL Listening Comprehension, is enabling test takers to answer detailed questions. This has close relation to one of the required skills, i.e. listen for answer in order.

Unlike the bottom-up process, top-down process is a type of listening strategy that focuses on listening for main ideas, predicting, drawing inferences, and summarizing. Learners, according to Nunan (2003), start from their background knowledge on either content schema or textual schema. This background knowledge activates a set of expectations that help a listener interpret what is heard, and anticipate what will come next. The benefit for this process, in relation to TOEFL Listening Comprehension, is enabling test takers to answer questions dealing with main ideas, subjects, or topics of talks. However, due to the distance, listeners could miss some details.

Relying only on the knowledge base of English, during the test, is not sufficient. Test takers should be equipped with the strategies both general and specific ones. For examples, they are expected to 1) be familiar with the direction, 2) listen carefully to the conversations and talks, 3) know where the easier and more difficult questions are generally found, 4) be familiar with the pacing of the test, 5) never leave any answers blank on their answer sheet, and 6) use any remaining time to look ahead at the answers to the questions that follow (Phillips, 2001).

The two aspects above, having adequate knowledge base of English and understanding strategies, seem to be important requirements in obtaining better TOEFL scores.

METHODOLOGY

Research Design

Relevant to the purposes and the research questions previously mentioned, this study is descriptive in nature, aiming to get a picture of the major problems in the TOEFL Listening Comprehension experienced by students. It was used to establish the existence of phenomena by explicitly describing them (Seliger, 1989, p. 125). It involved a collection of techniques used to specify, delineate, or describe phenomena naturally without experimental manipulation.

This study used the specific data due to the bounded subjects and the limited scope. Specific phenomena were examined to gain in-depth understanding replete with the meaning for the subjects, focusing on process rather than outcome, on discovery rather than confirmation. This study is a case study, the results of which could not be generalized. It is in line with Burns (2000, p. 461), who states that this kind of study refutes a universal generalization.

This case study has some characteristics such as dealing with an examination of specific phenomena in terms of level of difficulties in TOEFL Listening section, the factors affecting the difficulties, and the strategies used by the students. The aims of this study were to uncover the most difficult part of TOEFL Listening section, to explore the influencing factors on the difficulties, and to find out the range of the strategies

employed by the students.

This study has certain limitations involving the scope and participants of the research. The study was conducted with a specific and limited scope: the major problems in TOEFL Listening Comprehension. Besides, the subjects participating in this research were also limited, only 12 students of Faculty of Languages. For these reasons, the result of this research cannot be generalized.

Such limitations may provide the opportunity for other researchers to conduct similar research with a wide range of scope and subjects. They may raise the research topics on the other TOEFL sections by employing more subjects from different faculties.

Participants

The participants in this study were the English-Department students and Japanese-Department students of Faculty of Languages. The participants consisted of 12 students: seven English-Department students and five Japanese-Department students. The former were sitting on the 7th semester of S-1 program and the later on the 5th semester of D-3 program. In a nutshell, they were senior students finishing their studies.

The reasons for selecting the language students as the participants in this research were based on the practicability and accessibility considerations. By practicability, I mean I have recognized them personally because I have previously taught them when they were sitting on the first year. By accessibility, I mean I have had the personal data of the participants covering name, student number, address, and mobile phone number. These bases had enabled me to contact them easily, particularly in the case of making appointment for interviews.

Data Collection

The data were collected through employing three instruments: 1) test results, 2) questionnaires, and 3) interviews. The triangulation instruments in data analysis enabled the study to get more than one perspectives on the topic being researched so that this kind of data collecting method may confirm findings obtained from different perspectives (Wallace, 2001, p. 36, 109).

1. Test Results

After all of the participants together with other test-takers took the TOEFL test taken from *TOEFL Practice Tests Vol. 2* (ETS, 1998, p. 17-19), team members of the test scorers scored their answer sheets based on the determined scoring system issued by Educational Testing Service (ETS).

However, the researcher focused on the Listening Comprehension section. This section consists of 30 short conversations, 2 long conversations followed by 8 questions, and 3 talks followed by 12 questions. The test results were intended to gain the comparative difficulty of each part in the Listening section. Then through the percentage analysis of the correct answers of each part, the level of difficulty was identified. The following is the table of difficulty level derived from the TOEFL Book entitled *TOEFL: Test Preparation Kit Workbook, ETS* (1998, p. 263).

Table 2: Level of Difficulty

Range of Percentage	Level of Difficulty
80 - 100	Easy
60 - 79	Medium
00 - 59	Difficult

After finding the most difficult part, then an analysis to uncover the substance behind the part was conducted. In this analysis, the questions presented in this part were viewed through employing Bloom's taxonomy in terms of cognitive domain related to the types of questions proposed by Nuttal (2005). The analysis was able to uncover the reasons why the part was so difficult that most students chose the incorrect answers, and relating to these reasons, it was also able to identify the skills and knowledge that the students should have in order to discover the correct answers. This instrument was expected to address research question two dealing with factors affecting the difficulties in TOEFL Listening Comprehension.

2. Questionnaires

The questionnaires used closed-ended questions. However, to avoid the limited breadth of responses, the researcher also used some open-ended questions. This allowed the respondents to give more freedom of responses (Fraenkel, 1990, p. 339). There were two considerations on

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using the questionnaires in this study: 1) it may elicit truthful responses because it guarantees confidentiality; 2) the influence of personal appearance, mood or conduct of the researcher to the answers given by the respondents is not present (Burns, 2000, p. 581).

Questionnaires were used to obtain information through the respondents' responses to a list of statements/questions regarding 1) comparative difficulties in each part of the TOEFL Listening section; 2) factors affecting the difficulties in the TOEFL Listening section—the aspects presented in these factors were partly borrowed from the research findings conducted by Nissan (1996), for examples: vocabularies, functional expressions, and negatives; and 3) strategies to answer TOEFL Listening items during the test.

3. Interviews

To enhance the validity of the data obtained from two other instruments (test results and questionnaires), interviews were also used. The type of the interviews conducted in this study was the structured ones, and the answers to the interview questions were recorded and transcribed. The consideration of this kind of instrument was to clarify any questions that were obscure and also to ask the respondents to expand on answers that were particularly important (Fraenkel, 1990, p. 94). In line with this, the use of the interview was to confirm the data collected through the test results and questionnaires and to seek further information related to the students' results of the test, and their responses in the questionnaires. The main points obtained through interviewing were to identify 1) comparative difficulties in each part of the TOEFL Listening section that the students experienced; 2) factors affecting the difficulties in the TOEFL Listening section; 3) strategies students used to cope with the difficulties.

RESULTS AND DISCUSSION

The Degree of Difficulties among the Three Parts

The test results show that the three parts in the paper-based TOEFL Listening section are different in degree of difficulties. Short conversations (Part A) is easy, long conversations (Part B) is medium, and talks (Part C) is difficult. It is in line with the results obtained through

questionnaires and interviews: 92% of the students stated that talks (Part C) is the hardest part in TOEFL Listening section.

To uncover the reason why talks (Part C), consisting of 12 items ranging from question number 39 through 50, was deemed the hardest, Bloom's taxonomy could be used to view the characteristics of the items in this part. From the viewpoint of Bloom's taxonomy in terms of cognitive domain (knowledge, comprehension, application, analysis, synthesis, and evaluation), Part C is perceived the most difficult part because the questions presented in it are mostly classified into analysis level, and logically the answers to the questions in this part require higher intellectual capacity. The key words used in this level are *infer, identify, relate*, and *analyze*. An analysis level question is similar to a question of inference, a type of question proposed by Nuttal (2005). The question is also included in the higher level of questions that obliged the students in the test to consider what was not explicitly stated.

Of the twelve items in Part C, six of them (50%) were categorized into analysis level, four items (33%) into comprehension level, and two items (17%) into knowledge level.

In this paper, the researcher focused on the questions of analysis level, i.e. questions no. 40, 42, 43, 46, 49, and 50. Such a level of questions was perceived from the viewpoints of the cognitive domain of Bloom's taxonomy (1956). They were indicated by the key words used (infers, identifies, relates, analyzes). This level referred to the ability to break down a message into its constituent parts in order to make explicit the relationship s between ideas, including tasks such as recognizing the connotative meaning of words, correctly processing a dictation, and making inferences (Carneson, 1996; Clark, 2007). The six questions aforementioned are presented as follows.

No. 40: Why does the speaker mention that more than seventy percent of people read food labels?

- A. To demonstrate that current consumer trends are stable.
- B. To compare current consumer trends to those of the past.
- C. To indicate that most consumers actively research the products they buy.
- D. To show that there has been a decrease in consumer awareness.

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The question why asks for the reason and it can be replied by expressing the purpose. This question asked the students to make **inference** on what the speaker stated (..., since seventy percent of people read food labels when considering whether to buy a product).

- No. 42: What did the survey of food shoppers reveal?
 - A. They were unable to comprehend a label without percentages.
 - B. They preferred more basic labeling.
 - C. They were unwilling to do simple arithmetic.
 - D. They thought the language on labels was too technical.

This talk is about the current study on the food labels. This question required the students to identify the main problems of the study, relate and analyze the given information in order to discover the answer. Later on, this question (the last question of talk one) asked the students to find the concluding remarks from the study (The consumer group, ..., had cited a survey in which shoppers were shown a food label, The shoppers weren't able to answer the questions easily when they were not given a specific percentage).

- No. 43: What is the purpose of the talk?
 - A. To describe a college training program.
 - B. To recruit people for a job.
 - C. To discuss problems faced by the airline industry.
 - D. To describe a recent trip.

The information that the question wanted to get is similar to the information that the one posed on the item no. 40 above. This question asked the students to make inference on what the speaker stated (We're especially interested in recruiting people to fill openings for flight attendants). So, it was obvious that the question required the students to infer from the related expression.

- No. 46: Why does the speaker mention headwaiters?
 - A. To introduce the next speaker.
 - B. To explain her previous job.
 - C. To describe some of the skills flight attendants need.
 - D. To describe the background needed by applicants.

Like the previous item no. 40, the question why can be replied by expressing the purpose. This question required the students to make **inference** on the speaker's statement (A lot of our graduates say that our flight attendants develop the skills of a nurse, a headwaiter, and public

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relation executive!). The ability to relate a profession (a headwaiter) to another part within the same statement (skills) enabled the students to discover the answer.

No. 49: What does the speaker mean by the phrase "the energy balance of the Earth"?

- A. The releasing of heat from the Earth's core by volcanoes.
- B. The amount of energy used by different countries around the world.
- C. The rate at which sunlight is converted to heat by the Earth.
- D. The amount of fossil fuels stored in the Earth.

The meaning of the phrase "the energy balance of the Earth" is not explicitly stated in the oral text. This question required the students to make inference on the explanation following it (..., changes in climate occur when the energy balance of the Earth is disturbed. Solar energy enters the Earth's atmosphere as light and is radiated by the earth's surface as heat). From the speaker's explanation, it could be inferred that there is energy conversion from light to heat.

No. 50: Why do meteorologists have difficulty testing hypotheses about climatic changes?

- A. Computer models are inadequate.
- B. Climate changes too quickly.
- C. Instruments for collecting field samples are not reliable.
- D. Meteorologists cannot agree on key terms.

This question asked the students' understanding on the sentence showing cause and effect, which later on can be used to discover the answer. The question required the students to make inference from the statement of the speaker (The system is so complex that, to date, our best computer models are only crude approximations and are not sophisticated enough to test hypotheses about the causes of climatic change). From this long statement, it can be inferred that computer models are not enough to test the hypotheses.

Factors Affecting the Difficulties

Using Cohen's (1994, p. 36) terms dealing with factors affecting the difficulties, there are two different factors affecting students' difficulties in catching the contents of the talks as well as in finding the correct answers: 1) individual factors, covering stable factors and transient factors; and 2) situational factors.

From the aforementioned factors, the stable ones became the dominant factors affecting the difficulties of TOEFL Listening Comprehension. They covered 1) very academic talks, 2) infrequent vocabularies, 3) speed delivery, and 4) test takers' prior knowledge. The first factor relates to the contents of the talks and the questions presented in this part. The contents are very academic in nature and the questions posed are mostly classified into analysis level that requires higher intellectual capacity. The second factor is parallel with what Phillips (2001) dealing with vocabularies and the synonym of the key words of the related expression in the oral text. The third factor affecting the difficulties is about the rate of delivery (Brown, 2001, p. 252). The last factor relates to test takers' prior knowledge. This finding is relevant to one of the types of accessing process of information, top-down process, (Nunan, 2003). In this study, the topics of the talks were considered to be beyond the students' knowledge. Consequently, they were not able to access the information through top-down process.

Strategies Employed by the Students to Cope with the Difficulties

The discussion regarding the strategies used by the students (for Part C) covered the ones that were popular and productive, and popular but not productive.

The popular and productive strategy for Part C was listening carefully and catching the main point (topic) of the talks. This helped them answer general questions like topics, subjects or main ideas of the talks. It was also in line with one of the Part C strategies suggested by Phillips (2001, p.88): 'listen to the first line of the talk because it often contains the main idea, subject, or topic of talks.' However, understanding the gist of the talk was not adequate to answer detailed questions. Predictably, they guessed the answers to the detailed questions.

The popular but not productive strategy was *guessing*. In other words, the students did not have strategies except *guessing*. This strategy was seemingly the only last way to find the best answer instead of leaving the answer blank. In so doing, the students seemed to know that there was no penalty for *guessing*. However, this absolutely did not work much in finding the correct answers.

CONCLUSION

Talks (the content of Part C in TOEFL Listening section) were considered to be the most difficult part in the test because of reasonable reasons. The very academic contents of the talks, which belong to the analysis-leveled type of question presented, have been contributing factors to the difficulties of the talks. Such a level of questions requires higher intellectual capacity. In addition, the test takers did not adequately possess the capacity of analytical thinking, which in turn affected the test takers' comprehension on what they heard. Inevitably, they guessed the answers. In other words, they did not have the productive strategies in completing the test.

REFERENCES

- Brown, H.D. (2001). Teaching by Principles: An Interactive Approach to Language Pedagogy (second edition). New York: Pearson education.
- Burns, R.B. (2000). Introduction to Research Methods (fourth edition).

 NSW: Longman.
- Carneson, John, (1996). Designing and Managing MCQs: Appendix C: MCQs and Bloom's Taxonomy. Retrieved November 6, 2007 from http://web.uct.ac.za/projects/cbe/mcqman/mcqappc.html
- Cohen, A.D. (1994). Assessing Language Ability in the Classroom. Boston: Heinle and Heinle Publisher.
- Fraenkel, J.R., & Norman E.W. (1990). How to Design and Evaluate Research in Education. New York: McGraw-Hill Publishing Co.
- Nissan, S., Felicia D., & Linda T. (1996). Research Reports, An Analysis of Factors Affecting the Difficulties of Dialogue Items in TOEFL Listening Comprehension, Educational Testing Service. New Jersey: Princeton.
- Nunan, D. (Ed) (2003). *Practical English Language Teaching*. New York: McGraw Hill.

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- Nuttall, C. (2005). *Teaching Reading Skills in a Foreign Language*. Oxford: Macmillan Heinemann.
- Phillips, D. (2001). Longman Complete Course for the TOEFL Test. New York: Longman.
- Rost, M. (2002). *Teaching and Researching Listening*. England: Pearson Education Limited.
- Saricoban, A. (1999). *The Teaching of Listening*. Retrieved February, 5 2007 from http://iteslj.org/articles/Saricoban-Listening.html.
- Seliger, H.W., and Elana S. (1989). Second Language Research Method. Oxford: Oxford University Press.
- Wallace, M.J., (2001). Action Research for Language Teachers.

 Cambridge: Cambridge University Press.

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APPENDIX

Tape Script for Part C (Talk One – Three)

Talk One: Food Labels

(man)

Current studies show that what goes on labels is an important consideration for manufacturers, since more than seventy percent of

A recent controversy as to whether labels on prepared foods should educate or merely inform the consumer is over, and a consumer group got its way. The group had maintained that product labels should do more than simply list how many grams of nutrients a food contains. Their contention

the product will supply to the consumer, because this information is essential in planning a healthy diet.

A government agency disagreed strongly, favoring a label that merely informs the consumer, in other words, a label that only lists the contents of the product. The agency maintained that consumers could decide for themselves if the food is nutritious and is meeting their daily needs.

The consumer group, in supporting its case, had <u>cited</u> a <u>survey</u> which shoppers were shown a food label, and were then asked if they would need more or less of a certain nutrient after eating a serving of this product. The

given a specific percentage.

This study, and others helped get the new regulation passed, and now food products must have the more detailed labels.

Talk Two: Career Explanation Given by an Airline Representative at a College Fair

(woman)

Good afternoon. I'm here today to talk to you about a career with our airline.

flight attendants.

First of all, to work as a flight attendant with us, you must be accepted into our training program – and with so many people applying, it's not easy to

be selected. From the thousands of the applications that we receive annually, we choose fewer than a thousand people for training. So, we require experience serving the public; and it also helps if you've earned some college credits.

Also, not everybody who gets accepted into the training program makes it through. The course meets six days a week for five weeks. The training includes extensive classroom work in <u>such subjects as</u> first aid and <u>passenger psychology</u> as well as practical training in flight procedures and meal service. A lot of our graduates say that our flight attendants develop

But, as a flight attendant myself, I can say that all of the hard work is worth it. Of course, I get to travel throughout the country, and the airline pays all of my expenses while I'm away from my base station. And, what I lie best of all is that I've made friends with people from all over the country!

Talk Three: Lecture in a Geology Class.

(woman)

Today I want to talk about the Earth's last major climatic shift, at the end of the last ice age.

But first, let's back up a moment and a review what we know about climatic change in general. First, we define "climate" as consistent patterns of weather over significant periods of time.

In general, changes in climate occur when the energy balance of the Earth is disturbed. Solar energy enters the Earth's atmosphere as light and is radiated by the Earth's surface as heat. Land, water, and ice each affect this energy exchange differently. The system is so complex that, to date,

sophisticated enough to test hypotheses about the causes of climatic change.

Of course, that doesn't keep us from speculating. For instance, volcanic activity is one mechanism that might affect climatic changes. When large volcanoes erupt, they disperse tons of particles into the upper atmosphere, where the particles then reflect light. Since less light is entering the system of energy exchange, the results would be a cooling of the Earth's surface.

Of course, this is just one possible mechanism of global climate change. In all probability, a complete explanation would involve several different mechanisms operating at the same time.

