〈English Immersion Education〈Science〉〉

Studies of Implementing English Immersion Education
— The Idea of Science Lessons Utilizing Second Language Acquisition Theory —

Toru Omine
Ageda Junior High School

Ⅰ　Introduction

“English has become the international lingua franca, a process accelerated by the Internet and globalization. So long as English is effectively the language of international discourse, there is no alternative to familiarizing ourselves with it within Japan. Even if we stop short of making it an official second language, we should give it the status of a second working language and use it routinely alongside Japanese.” These sentences are parts of “The Frontier Within: Individual Empowerment and Better Governance in the New Millennium”. At that time that report was published, there were many arguments about “English the second official language.”

In these circumstances, The Ministry of Education, Culture, Sports, Science and Technology made “An Action Plan to Cultivate ‘Japanese with English Abilities,’” and Okinawa Prefecture is training public school teachers to promote English Immersion Education to educate students to be internationally-minded and have broad perspectives.

Immersion Education is a school education program to develop students’ second language (L2) ability by using L2 in all or part of the school education without sacrificing development of the first language or their personality (Stern 1972:1. 1976). Now, this education program is used in Canada, America, and European countries.

It is an important fundamental for immersion education teachers to study the mechanism of the second language acquisition (SLA) to teach without misleading assumptions or prejudices. So I researched the idea of science lessons utilizing Second Language Acquisition Theory.

Ⅱ　The Content of Research
1　Ages and Second Language Acquisition

Penfield & Reverts (1959) and Lenneberg (1967) insist that there is a “Critical Period”. This is a certain time when person can acquire a foreign language easily; and if a person misses that time, he or she cannot acquire foreign languages perfectly. This theory is called the “Strong Version of Critical Period Hypothesis” and there are many reports to support this theory. These reports say that it is very difficult to acquire foreign language pronunciation and grammar if we start studying past a certain time. But, on the other hand, there are many case reports of learners who past the age of adolescence still acquired ability like a native speaker.

From these discussions, the theory of the “Sensitive Period” was formed. The term “Sensitive Period” was introduced by Lamendella (1977). He insisted that there is an effective period for a person to acquire foreign languages, but it is possible to acquire them depending on learning methods and their surroundings. Functional magnetic resonance imaging compared the brain function of bilingual speakers when they are speaking the second languages, to when they are speaking their first language. They found that persons who acquired a foreign language in adulthood deal with two languages in separate parts of their brain and persons who did it at childhood deal with both languages in just one part of their brain.

From the above, learners can acquire L2 easily when they start learning at an early stage, but they can still do it fully in past this age. But from the brain function, it is inappropriate for adults and children to use the same learning method. Where students are adolescents, their thinking has developed to a certain level, so I think it is necessary for learners to study logical language forms specifically. Furthermore, at this stage of development, there are many differences in acquired language level so learners need strong motivation.

Okinawan English immersion education is going to start from the junior high school level. Immersion teachers have to devise effective ways of teaching in consideration of the students’ ability to understand in the learning environment.

2 Second Language Acquisition Theory

(1) The Role of Input

In school, it is extremely important for students to input information to study. Krashen's Input hypothesis is that if adults are exposed to lots and lots of comprehensible input, they can acquire a second language naturally like child. But there is much evidence against that hypothesis. Now, when promoting second language acquisition, it is necessary for learners to pay attention to language forms while being exposed to lots of comprehensible input.

Oishi (2006) attempted a neurological approach to the second language acquisition, she suggested that if problems of the appropriate difficulty are given to learners using suitable methods, they can get what is called Krashen's comprehensible input and their brains can be at their most active state.

I think immersion teachers should give students comprehensible input that is with in the grasp of their language level, and it is most effective to use teaching material of appropriate difficulty.

(2) The Role of Interaction

Long's interaction hypothesis proposes that language acquisition is strongly facilitated by the use of the target language in interaction. In particular, "the negotiation of meaning" has been shown to contribute greatly to the acquisition of vocabulary (Long, 1996). "The negotiation of meaning" involves clarification of misunderstanding and uncertainties, confirmation of correct understanding, and comprehending when the other person doesn't understand.

(3) The Role of Output

In a study conducted with Canadian immersion students, Swain showed that even though students had received abundant comprehensible input in French and were somewhat fluent, they had still not acquired grammatical competence in the language. Swain suggested that "output" was the missing factor and called the concept "comprehensible output" and has been credited with first articulation what has come to be called the "Output Hypothesis." Currently, the roles comprehensible output may play are seen to be the following: (1) Comprehensible output can lead a leaner to "notice" the hole what they can't say in L2. (2) Comprehensible output can lead a learner to "notice" the gap between what they want to say and want they actually can say. (3) Comprehensible output can lead a learner to be "conscious" of how to speak in L2. (4) Comprehensible output can allow a learner to speak L2 fluently.

Now, many experiments have been conducted to verify the Output Hypothesis. It has become clear that comprehensible output is extremely important to develop ability with L2. In particular, output activity is a significant cognitive process in acquiring L2.

So, it is important for immersion teachers to give students maximum opportunities for output activities.

3 The Idea of Science Lessons Utilizing SLA Theory

(1) Educational Guidance based on Input

① The Schema Theory

According to the Schema theory, if learners have a schema (background information) about the learning text, they can understand it more easily. But if learners do not have a schema, their cognitive activity is lower, they have greater misunderstandings about the text, and because they must pay attention to new information, they can't process the information as effectively. Schema functions as guide, making a preparatory state to more easily understand the text.

Oishi (2006) compared when a learner is presented with background information with when a learner is not presented with it and examined the differences in the brain activity. Oishi says "in the same learner with the same subject, when the background information about the subject was presented before it is done, the learner can understand it more easily. In other words, by changing how to present a subject, the degree of understanding changed and the state of brain activation changed too."

According to this theory, in the beginning of a science lesson, immersion teacher should give students information (pictures, movies, guide questions, etc.) about the subject and figure out good ways to present the subject. Students' schemas become more active so they can readily comprehend the subject.

② Language Use In the Classroom

According to the previous bilingual education research, it's preferable that a teacher sticks to one language when teaching a subject rather than using more than one language (Lindholm 1990). They point out that if a teacher uses more than language in the class, students will expect an easily comprehensible explanation in their first language, and these students will not pay attention to an explanation in L2.

In the immersion class, a teacher should use English only. It is not recommended to use Japanese to give easily comprehensible input. When students cannot understand the L2 explanation, it is more effective to make paraphrases of simple expressions.

(2) Educational Guidance based on Interaction

Pair and Group Activity

Long et al. (1976) reported that when comparing whole class discussion lead by the teacher with pair activities, greater communication was seen in pair activities. Also, Pica and Doughty (1985, 1986) reported that when comparing lessons lead by the teacher with group activities, students performed greater negotiation of meaning in L2 in the group activities.

In science lessons, there are many experiments and observations. A teacher can plan various pair and group activities in the lesson. In doing so, students can achieve an "interaction effect."

(3) Educational Guidance based on Output

① Teacher's questions

Numan (1989:30) insists that "a broad division is made between a display question which the questioner knows the answer to and a referential question which the questioner does not know the answer to. A referential question can increase the number of students' responses and improve the quality of students' statements. Referential questions make learners exert more effort and require deeper thinking. So referential questions act as stimulus to acquire L2." However, display questions are necessary for learners to check their comprehension.

In the immersion class, the teacher makes maximum use display questions in the early stage of learners' language development and at the developed stages, the teacher mainly uses referential question. So it is important for the teacher to think about the balance of referential and display questions to develop the quality of output.

② Reading Aloud

Research has reported that reading books aloud is important to develop L2 ability. It is often pointed out that reading aloud performs a bridge from comprehension of L2 to production in L2. Furthermore it is also thought to be effective to speed up "automatic" or "procedural" processing in L2.

Takeuchi (2003) thoroughly analyzed methods of learning foreign languages by Japanese who succeeded in acquiring proficiency in L2. He says that many successful Japanese habitually read aloud over and over again. But there is not much reportage of this learning method in the Western SLA reports.

In Japan's language situation, most people don't use English in their life, so reading aloud is an effective output activity, and immersion teachers should give students many opportunities to read aloud.

Procedure	Learning Activities	The Approaches of SLA
Pre-Learning	① Schema Building (audiovisual materials, questions)	Input & Output
	② Key words	Input
Learning	① To give topical problems (of the appropriate difficulty)	Input
	② To do experiments and observations (group activity)	Interaction
	③ To announce results	Output
Post-Learning	① Conclusions	
	・ Explanations (comprehensible expression)	Input
	・ Questions (display & referential questions)	Interaction
	・ Discussions and Debates (at the developed state)	Output
	・ Reading aloud	

Figure 1: Science Lesson Model in English Immersion Education

Ⅲ Conducting of the Science Lesson

I planned the science lesson based on SLA Theory (Input, Interaction, and Output) as shown in Figure 1, and conducted the lesson at both Okinawa International University (OIU) and Yamauchi Junior High School (YJHS). The unit was "Classification of Animals" in the eighth-grade.

1 Procedure

Pre-Learning

A. Schema-building (Input & Output)
・ Give students display questions to built students' schema about animals.

> Animal Quiz
> What animal has a long nose? What animal has a long neck? What animal jumps and eats flies? What insect drinks blood? What insect makes honey? What animal is long and has no legs? Etc.

B. Key Word (Input)
・ Explain the definition of "Classification" and show how to classify organisms.

> Key Word
> Classification

・ Show students four picture sheets and ask students how we could make them into two groups.

Learning

C. Group Activity 1 (Interaction)
・ Give students 12 animals cards and ask students ways to divide these cards into two groups. Students discuss with each other about the basis of their classification.

D. Presentation (Output)
・ Students present their classification

E. Explain about vertebrates and invertebrates.

> Animals can be divided into two main groups
> Vertebrates are animals with a backbone.
> Invertebrates are animals without a backbone.

・ Go on to explain that vertebrates can be divided into five groups.

> Vertebrates can be divided into five groups:
> Fish, Amphibians, Reptiles, Birds, Mammals

F. Group Activity 2 (Interaction)
・ Give students a worksheet; they find characteristics of each of the five groups of vertebrates by using general research materials on animals.

G. Announcements of the results (Output)
・ Students make a presentation of the results of their research (using name cards).

Post-Learning

H. Ask students to spot the mistakes.

> Animals can be divided into three main groups.
> Vertebrates are animals without a backbone.
> Vertebrates can be divided into four groups.
> A whale is fish. Sea snakes are amphibians.

I. Teacher's presentation. (Input)
・ Tell the story of the Habu, a poisonous snake that lives in the Islands of Okinawa. What kinds of Habu live in the Okinawan Islands? Explain about the habitant distribution of Habu and the Taiwanhabu that was caught in Nago City. A hybrid between Habu and Sakishimahabu was found.

2 Verification of the Science Lesson

(1) About Input

In response to the question, "Did you understand teacher's explanations?" (Fig. 2) most students from both OIU and YJHS replied "Very good" or "Good." Some students from OIU gave their impressions as follow: "Your explanation is easy to understand even for junior high school students. It is easy to understand because

you use simple words." Some students from YJHS expressed the sentiment that "this lesson was more interesting than I thought and I enjoyed understanding English." Another said, "I didn't understand all of it, but I enjoyed it."

Many students of both schools replied "Very good" or "Good" to the question, "Was the PowerPoint presentation effective?" (Fig. 3) As reasons, OIU students mentioned, "By using not only characters but also pictures and photographs, I could understand more easily." Another said, "visual aids are appealing to students."

To the question, "Did you understand the classification of animals?" (Fig. 4), many students from both schools replied "Very good" or "Good". Some OIU students said, "It is good that there are simple explanations and pictures for the difficult words"; "At first, you explained the key word "Classification" and I could understand throughout"; "You explained using some drawings and photographs mainly, so I could understand difficult words like 'amphibians'."

From the above, I think I could achieve "comprehensible input" in these lessons. As implied by the students' comments, I think that "Schema and Key words" related to the subject had the effect of promoting understanding in the pre-learning. But I think that there is a problem concerning the language acquisition aspect to the lesson, because most students appreciated the effect of drawings and pictures. In a recent SLA study, Takeuchi (2000) reported that "people tend to put audiovisual information like images ahead of the voice information. In the case of a lot of audiovisual information, people pay attention to it automatically and it is difficult for them to pay attention to voice information. If so, people cannot store information in their language variation database, therefore listening ability is delayed." That is to say, in these lessons, most students may understand by looking at drawings or pictures, not necessarily by listening to the teacher's explanation.

Immersion teachers always try to speak a lot of comprehensible English expressions. They should consider a balanced use of both audiovisual materials and verbal expressions. Verbal expressions are vital to students' ability acquisition.

(2) About Interaction

OIU students mentioned, "I think group activity is much better than thinking by myself because I can hear many opinions", "I think pair activity is good since we can reflect on each other's opinions." To the question, "Was the group activity effective?" (Fig. 5), most students answered "Very good" or "Good."

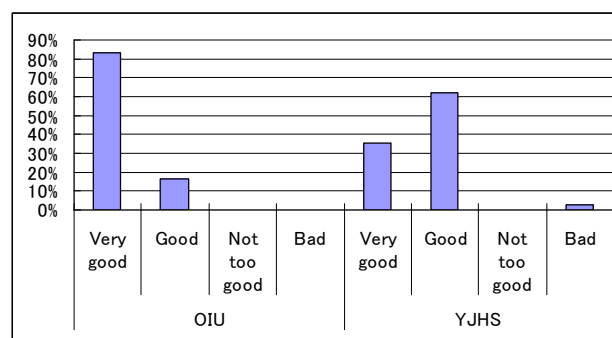Figure 2: Did you understand teacher's explanations?
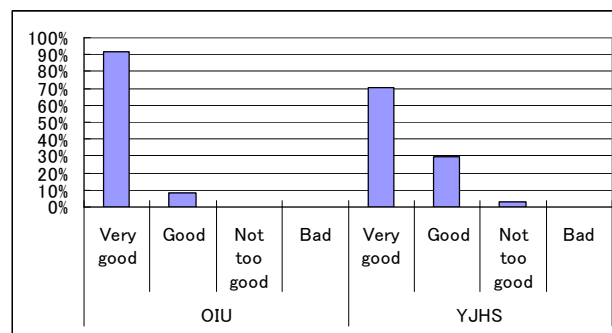

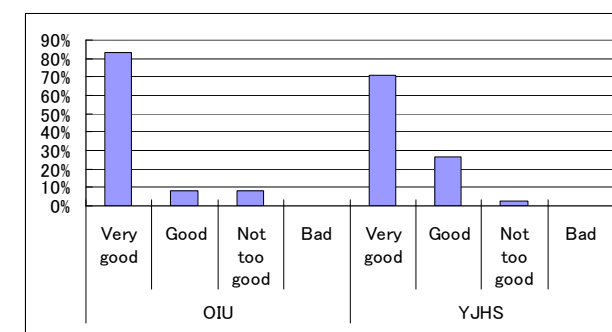Figure 3: Was the PowerPoint presentation

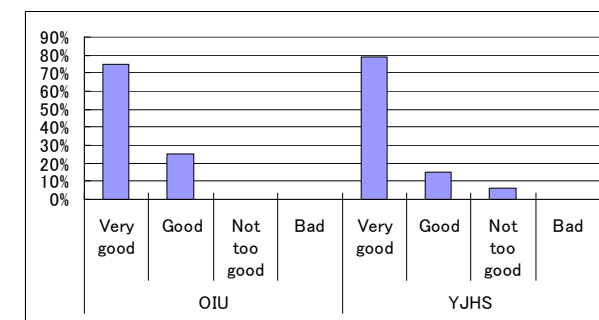Figure 4: Did you understand the classification of animals?

Figure 5: Was the group activity effective?

Group activity is a good way to develop students' ideas and thinking in all subjects. Also it is an effective way to acquire L2 by practicing "negotiation of meaning" in that language more actively. But in these lessons, I could not guide students' active interaction in English. YJHS students talked to each other in Japanese.

While keeping in mind the important role of interaction, I think that students' SLA will be promoted by continued group activity in the science class.

(3) About Output

Picture 1: The group activity at YJHS

From the observation of the lessons, I found that OIU students the activities. During the lessons, they also asked their questions in English, like "why don't Habu live in Miyako Island?" YJHS students couldn't speak voluntarily but I tried to get most students to speak by randomly using name cards. Also I prepared a lot of simple questions in English and I permitted students to speak in Japanese. Few students answered in English but most of them could do so in Japanese.

From these observations I think that it is necessary to create an output approach for students during early SLA development.

Ⅳ Conclusion & Future Tasks

1 Conclusion

(1) I created a science lesson model utilizing the SLA theory, i.e. "input, interaction, output."

(2) To conduct comprehensible input, it was effective to give students the schema (background information) about learning contents at the pre-learning stage. Immersion teachers should not speak in Japanese; they should make paraphrased English explanations in case of trouble in understanding, and give students lots of comprehensible English Input.

(3) Pair and group activity permitted more effective interaction. By setting the subject for discussion, "the negotiation of meaning" was performed more smoothly.

(4) Output activity is necessary for creating an input approach according to the students' SLA development levels. I think at the early SLA stage, questions that are simple to answer and reading aloud will be good approaches, and at the development stage, referential questions and discussion are more effective.

2 Future Tasks

(1) To develop teaching materials with appropriate difficulty levels based on students' comprehension stage, and to create ways to present these materials.

(2) To develop a teaching approach that is focused on logical language form in science lessons.

(3) To create simple English expressions for technical expressions in science.

(4) To study learning approaches that promotes "negotiation of meaning" in interaction activities.

(5) To create teaching materials for reading aloud in science.

〈 Reference 〉
竹内理　2007　より良い外国語学習を求めて　外国語学習者の研究　松柏社
小池生夫・寺内正典・木下耕児・成田真澄　2006　第二言語習得研究の現在−これからの外国語教育への視点−　大修館書房
大石晴美　2006　脳科学からの第二言語習得論−英語学習と教授法開発−　昭和堂
コリン・ベーカー　岡秀夫訳　1996　バイリンガル教育と第二言語習得　大修館書店
小池生夫　1994　ＳＬＡ研究会　第二言語習得研究に基づく最新の英語教育　大修館書店