AN INTEGRATED TEACHING OF ENGLISH AND MATHEMATICS: An Overview

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P E N G A N T A R

An Integrated Teaching of English and Mathematics merupakan salah satu metode mengajar yang pernah dilakukan penulis pada saat mengajar di Play Group - Children's English School - salah satu sekolah Bahasa Inggris untuk anak-anak di Padang, selam lebih kurang 5 tahun. Pada saat mengajar penulis menggabungkan dua tema, Bahasa Inggris dan matematika.

Dari pengalaman-pengalaman tersebut penulis tertarik untuk mengutarakannya kembali dengan memberikan beberapa analisis berdasarkan teori-teori belajar dan konsep-konsep baru dalam pengajaran Bahasa Inggris untuk anak-anak.

Semoga tulisan singkat ini dapat menjadi inspirasi bagi guru-guru Bahasa Inggris, khususnya yang mengajarkan Bahasa Inggris untuk anak-anak, dalam mengkreasikan aktivitas-aktivitas mengajar di kelas bahasa yang mereka tangani.

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An Overview

I. Introduction

The integration of English with Mathematics cannot be easily defined as it involves a broad range of aspects, such as ways of learning, ways of knowing, process and thinking skills, content knowledge, attitudes and perceptions, and also teaching strategies. All of these aspects are not intended to be isolated nor exclusive of one another in reality. The goal of integrated English and Mathematics teaching is to enable students to acquire both language ability (English) and scientific thinking simultaneously.

Some researchers have also argued that integrated teaching facilitates students to see the connection between fields of study. Students begin by carrying over ideas from one subject area to another. As they make additional links, the material becomes more relevant and their learning is thus reinforced. It is assumed that mathematics will enhance the acquisition of English and vice versa.

According to Piaget (Kennedy & Tipps, 1994), the process of learning is continual assimilation and accommodation. As students have new experiences, they actively try to make sense of the new ideas in relation to their old experiences and old ideas. It means that students learn when they see how new materials are related to their lives. They understand when they hook new materials onto what

they have already known and connect them to what they are studying in classes. They succeed when they can learn through other strengths. They need materials that cause light bulbs to come on and ideas to click, materials that result in meaningful, lasting learning.

Short (1989), in relation to the idea of integrated teaching of English and mathematics, posits that content-based foreign language instruction is currently defined as an approach that integrates language instruction with subject matter instruction. Each lesson in a content-based class has content objectives (e.g. math, science, social studies) and language objectives (e.g. grammar, functions). Students learn a language through the context of specific subject matter rather than through isolated language feature. The key point in language teaching and current emphasis on content-based instruction is the realization that subject and language learning go hand in hand.

Another important concept is that language is learned and used to fulfill communicative needs (Krashen and Terrell, 1985). Working from this principle, Krashen and Terrell developed the Natural Approach to language teaching and learning. The goal of the Natural Approach is to develop basic communication skills. It is based on the following principles: 1) comprehension precedes language production; b) production emerges gradually; and c) activities that foster acquisition and lower the affective filter are of crucial importance. The Natural Approach centers around situations, functions, and topics using activities that foster communication. In the Natural Approach, it is important that the topics and situation chosen relate to the personal experiences of the students. Useful teaching techniques include Total Physical Response, affective-humanistic activities (dialogues, preference rankings, interview, etc.), problem-solving activities (including charts, graphs, and maps), games and content activities.

Actually, content-based foreign language instruction at the beginning level (pre-school) is a relatively new concept which has not yet been widely applied. Nevertheless, some experimental programs have been developed. Anderson (1989) has put together a content-based curriculum for teaching French at the elementary school. The program centers around common themes, such as numbers, animals, or the weather, and develops language and content skills (mathematics, science, social studies) at the same time in each unit by using appropriate activities. Her approach is a totally integrated one which could easily be adapted to teaching English as a foreign language at the elementary level.

II. My Own Experience in Integrating English with Mathematics

I have had an experience in integrating English and math when teaching pre-school children at Children English School of Yazid Association in Padang, Indonesia.

There were 12 students in the class ranging from 3 to 5. They were to learn English combined with mathematical concepts.

The lessons learned were color, location words (in, out, top, bottom, above, under, etc.) shape words (circle, square, triangle, and rectangle), number 1 - 10, time words (night, day, etc.). They were being linked to mathematical concepts: classification being linked with color, location with location words, geometry with shape words, number with 1 - 10, and time with time words).

In learning those lessons, some manipulative materials such as coloring pencils and crayons, cubes, papers, M & Ms candy, counters, 3-dimensional geometric shape and other materials were used.

In the following pages one example of integrated teaching of English and mathematics is outlined. It is believed that the types of activities described will foster English as well as mathematics.

Activity 1: Color and Classification

Language objectives: to introduce the color red, yellow, green, blue, orange, black, and brown. Language used: "It is red, It is not blue", and so forth.
Related language: "This cube is red, yellow, blue, ..."
Materials Needed: Teddy Bear (1 red, 2 blue, 3 green) to use in telling a story; interlocking cubes, crayons and coloring pencils for classifying the color and coloring several pictures; some

colored construction papers to cut out a variety shapes of various colors.

Procedure: Firstly, I told the children a story about Teddy Bear Family by using the picture and Teddy Bears. Then, I engaged my students in the story by classifying the teddy bears based on the color. In the second activity, the students were divided into groups and each group was provide with a packet of interlocking cubes, crayons and pencils. The students scattered the materials on the rug, and sorted the material by color in groups. I went around and joined in the groups, then discussed how they were sorting the materials. The next step was a whole-class activity in which teacher elicited the names of the color. After that, the names of the color were written on the white board. Then I had the students attached various color on a flannel board according to my directions. As a follow-up activity, I asked the students to color a picture by using their favorite color. The other activity was to paste the construction paper that has had already been cut out by the teacher to their drawing books.

III. Data

The class activities and students response are described as follows:

1. When the teacher taught the color and classification, more than half of the students became enthusiastic. They moved directly when the teacher asked them to sit on a circle and listen to Teddy Bear Story. Some of them stood up and tried to touch Teddy Bear, and the others asked the teacher some questions: "Where does Teddy Bears sleep?", "Why are Teddy Bears so fat?". They asked the teacher through Bahasa Indonesia, but the teacher answered them in English. When they classified the manipulative materials (interlocking cubes, crayons, and pencils), they were really happy. They moved around, asked their friends and also the teacher in order to classify the materials correctly. Sometimes they laughed and shouted. Then, when the teacher asked them to name the color, they spoke loudly. They became calm down again, when the teacher gave them the Walt-Disney picture to be colored. They colored them by using their favorite colors and they were pleased to tell the teacher the name of the color that they used. But, there were still some students who did not take a part on the activities. They were rather ashamed of speaking loudly so they just kept quiet.

2. Almost all the students were interested in getting involved in learning Location. They moved around and tried to stand on the place that the teacher asked, for example: "Stand on the chair. Stand on the floor. Sit on the top of the red box", and so forth. When the teacher shared the manipulative material, they became excited and began to laugh and shout: "Teacher, give me Teddy Bear. Teacher, I want the cubes, I don't like the red block", and so on. When the teacher explained the location, the students listened carefully, but some of them played with their materials without paying attention to the teacher. After explaining the language concept and also the

math concept, the teacher asked the students to put their manipulative materials as the directions: "Put your cube in the box, take your cube out of the box", and so on. The students began to do that activity and asked their friends and also the teacher. After they familiarized themselves with the concept, they intended to take the material as soon as they heard teacher's instruction.

3. The students learned shape and geometry by using 3-dimensional geometric shapes and other manipulatives materials. Almost all students liked to explore the shape and geometry concept. When the teacher showed the picture of geometrical shapes and introduced the name of the shapes, some students stood up and came close to the picture and touched the picture, while the others gave some comments: "It is a ball" (for a circle), "No, it is not a ball, it is a balloon". Then, the teacher divided them into groups and shared the 3-dimensional geometric shapes. The students began to speak and give their comments again: "Teacher, I don't like this (take a circle), I want that one (pointed the triangle). They sometimes still spoke in Bahasa Indonesia, but teacher always responded in English.

4. When the teacher introduced the number, all students became enthusiastic. All students tried to spell the number as loudly as they could. The boys and some girls stood up and moved toward the teacher to speak up the number. They really wanted the teacher to know that they have known the number. After introducing the number, the teacher gave them the number cubes, interlocking cubes and other materials. Then the students began to explore numbers among the friends and also teacher. Sometimes, they also used their bodies such as fingers, eyes, ears to examine numbers when they discussed with teacher. They were also excited when the teacher asked
them to spell numbers from 1 - 10, so they told the teacher about how many pets and toys they had at home.

5. Some students were interested in telling about day and night activities. They paid attention to the teacher's stories and sometimes told about their activities at home. But some of them did not like these activities, they did not listen to the teacher, so they walked around the class, touched something. The teacher called them and asked them to sit. They obeyed her but they still did not pay full attention. When the teacher used the manipulative materials, those students began to get involved. They discussed about day and night activities by drawing pictures and taping them on the floor graph. Everybody became active and finally liked the lesson.

IV. Interpretation

The above description showed that half of the students learned the color and classification enthusiastically. They could classify and tell the color accurately. Then, almost all students were interested in getting involved when they learned the location and also shape/geometry concepts. They were able to use the location words and point the location of some manipulative materials in class. They were also able to mention and tell the name of the shape/geometrical concept correctly.

When the teacher introduced the number, the students absolutely showed their interest. Nobody kept quiet. Every student really wanted to show his/her ability in spelling the number. When the teacher explained about the time, not all students were exhausted. Some of them did not care about teacher's explanation, even though she explained time concept by telling a story.

From the above finding, it seems that children really like to explore the number. This fact might be caused by the habit of some people in Indonesia who tend to explore numbers to their young children when they begin to speak. Therefore, children became so excited when the teacher introduced the number. It seems that the teacher was recalling something that they had acquired before. But, it might be caused by the interesting manipulative materials that teacher used in class which looked like their toys.

The description of data also showed that almost all students were interested in learning the location and shape/geometry. It was really a good phenomenon, since these concepts have great relevance in building their spatial relationships skill. A good understanding of spatial relationships is an important characteristic of an effective problem solver. In addition, from the language point of view, these concepts will also develop their understanding about

the location words that are really important in their earlier communicative ability.

When the students learned the classification, the description above revealed that more than half of the students did the activity enthusiastically. It may happen since the students have developed classification schemes to make sense of the world from the very beginning stage of their development, as Kennedy and Tipps (1994) observe that a child calls a cat "kitty" and refers to any man as "daddy". Then, this classification scheme was strengthened by the activity using manipulative materials which have a connection with their real life.

However, only some students liked to tell about day and night activities, the class was still interesting. But this can be understood, since Piaget's research (Kennedy & Tipps, 1994) indicates that some children are ready to develop a full understanding of time by the age of nine, while as we know, the children in the class were between 3 and 5 years old.

Meanwhile, from the language point of view, language acquisition is a socio-cognitive process resulting from efforts to participate in communicative interactions. As the exchange and negotiation of conceptual, sociocultural, and affective content, mathematics provides a form of social and cognitive interaction that meets requirements for genuine language use. Mathematics provides a context in which English acquisition can occur. Student's efforts to pronounce mathematics words (number, shape, etc.) give opportunities to use their newly developed language in a communicative context.

When the teacher teaches in ways that utilize concrete objects and other devices to clarify meaning, mathematics can provide a source of meaningful, relevant input for English acquisition. Hands-on, concrete experiences used in working with shapes can

contribute to understand meanings. So can floor graph, charts and diagrams of flannel board.

By understanding to the class activities as described above, it can be seen that the students liked mathematics. Their positive attitude helped them integrate mathematics interest with their effort to use English. The students naturally discovered that mathematics is relevant to their world. Teacher-sensitivity, hence, to student language and mathematics proficiency contributes to setting the positive conditions needed for learning language and mathematics concurrently.

Moreover, with effective instruction, mathematics can contribute to providing the necessary affective conditions that support language development. The interaction of affective and cognitive experiences is central to the development of English just as it is to the development of mathematical inquiry. The curiosity, surprise, or need to resolve a cognitive conflict that affectively drives mathematical thinking also facilitates English acquisition. In mathematics instruction, the teacher can tap the student's prior knowledge of subject, build on it (as in number), and at the same time lead the student to the realization of that knowledge in a new language system. Affective variables may exert stronger effects with increasing age and maturity. The learner's attitude towards the new language and culture and the content area of mathematics can interact positively.

V. Discussion

From the above finding, there are some interesting phenomena need to be considered in teaching and learning English since the students tend to be more active in uttering the language and gain the input intensively. Moreover, the class activities above are probably helpful in reducing the textbook-oriented approach and also in developing student active learning.

In addition, according to Hiebert (1984), when children learn mathematics they learn the language needed to express meaning appropriate to the communication of mathematical ideas and they learn about the system of symbols that represent numbers, operations and the rules for manipulating them. Furthermore, Halliday (1975) defined a mathematics register as mathematical meanings with the terms or vocabulary used in expressing these ideas and the structure or sentences in which these terms appear. In broader sense, the language of mathematics may be viewed as communicative competence specific to mathematics, a subcomponent of cognitive or academic language proficiency (Cumins, 1984). The mathematics register may be viewed as intersecting with an underlying cognitive analytic mathematics proficiency as defined by Dawe (1984). The language of mathematics at last help the students to communicate in English when they work with mathematics.

The theoretical framework for communicative competence outlined by Canale (1983) is useful in analyzing language aspects of communication in mathematics. It identifies four components: grammatical, discourse, sociolinguistic, and strategic. Each component enters into processes linking language acquisition and mathematical thinking which possibly help the acquisition of English, itself.

To bring it to a conclusion, the processes of English acquisition and mathematics share many features cognitively and

affectively. Close examination of the relationships between development of mathematical thinking and English as foreign language indicates several key issues for instructional setting. De Avila (1983) has shown that under classroom organizational condition where limited English proficient students are provided with access to interactive, cooperative learning situation, students can acquire both mathematics and English simultaneously. As part of interaction, students use manipulative materials, or other aids that make the activity meaningful. Materials such as these used in an interactive organizational framework give focus to the meaning of activities. Students comprehend the input, in other words, they like doing the activities.

As educators have found, personalizing problem statement, lowering anxiety levels, presenting situations that are related to life experiences and are of practical significance to the learner have positive effects on performance (Silver & Thompson: 1984). These are conditions which facilitate English acquisition as well.

In short, integrated English and mathematics must be recognized for the complexities it presents. The cognitive and metacognitive aspects of mathematical reasoning must enter into any assessment of the role that mathematical input plays in facilitating English development. Affective variables are critical. The acquisition of English and mathematics can occur simultaneously if those elements which link both processes are taken into account. In a way, the central link is language itself.

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