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Navigating Teachers' Collaboration in Content Textbook Modification for ESL Students*

Young-Mee Suh**
(Ewha Womans University)
Ha Young Lee***
(Indiana University)
Eun Young Park****
(Indiana University)
Yoosun Jung****
(Seoul National University High School)

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This paper delineates the process of modifying authentic 4th and 5th grade math textbooks used in a Midwestern state of the USA. The goal is to help ESL students improve their Cognitive Academic Language Proficiency in addition to demonstrating the multiple layers of scaffolding needed for the effective instruction of CALP. Further, this paper aims to shed light on the issues related to the process of textbook modification and to discuss the pedagogical implications of this process for ESL teachers. The methods include Teacher Study Group meetings, interviews with a focus group, sample test, and personal learning logs. The most commonly used modification methods in the textbooks include insertion of additional pictures, glossary terms, and simplified directions in conjunction with the elimination of complicated questions. This modification project confirmed the effectiveness of the TSG dynamic. The final modification appears to increase ESL learners' problem-solving skills as well as their perceived self-efficacy with regards to mathematics in general. The limitations of this study and the implications resulting from diverging suggestions of the ESL teacher and math educator are further addressed.

[modification/cognitive academic language proficiency/teacher study group]

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** First author
*** Corresponding author
**** Co-author

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I. INTRODUCTION

We live in a constantly changing world where international communication is carried out and more frequently and information technology is developing more rapidly than ever before. As a result, the English language is now widely accepted in many industrialized countries as the mode of communication facilitating this new type of global economy. One consequence of the global expansion of English is that there are a significant number of students who learn English as a second language in elementary school. As researchers have become aware of the fact that focusing on academic reading skills does not guarantee effective communication skills (Cummins, 1989), we have been faced with the challenge of redesigning our approach to language learning. In order to help students excel as language learners, it is necessary to promote academic reading skills that are represented by the Cognitive Academic Language Proficiency (CALP) index in conjunction with communicative language skills as seen in the Basic Interpersonal Communicative Skills (BICS) index.

There is a growing need to integrate CALP related skills in elementary school curricula and it is up to the teachers and researchers to effectively design ESL materials to address this demand. One way in which researchers have attempted to address this need is to raise awareness of Content-Based Instruction and develop practical materials for ESL students using the framework provided by this approach. Using the Content-Based Instruction approach, the authors of this paper have modified authentic math textbooks currently in use in a Mid-western state of the USA.

This math textbook modification project for ESL learners is anchored in the belief that ESL students should not wait until they speak English fluently to start learning various subjects in English. There is often a gap between what ESL students can do in English and their native language. Students may be hindered by the linguistic aspects of being instructed in English rather than a lack of understanding of the mathematical concepts being presented. This project is aimed at demonstrating the multiple layers of scaffolding needed for the effective instruction of CALP which we hope will be useful to instructors. It is also designed with the needs of the students in mind and our ultimate goal is to enhance the students' CALP.

Our rationale for selecting math as the modification material is that math tends to be more approachable for ESL students. The use of numerical notation often makes it easier for students to grasp mathematical concepts in English even given limited English proficiency. Once ESL students learn math successfully, they can continue to adjust successfully to other subjects with confidence. Put it differently, it is important to fortify a second language learners' identity as a proficient language learner by introducing the target language through concepts with which they already have some degree of

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familiarity. Students who have demonstrated some mastery of mathematical concepts can use their knowledge to adjust to English instruction and ultimately better their comprehension across several other content areas.

Another premise of this math textbook modification is that it will be beneficial to modify textbooks through the use of the Teacher Study Group (TSG) framework. TSG is one of the most effective professional development approaches as it promotes continuous professional development and collaboration (Clair, 1998). In this sense, this study came out of collaboration not only among teacher-researchers but also with an ESL teacher, and a math education expert.

The purpose of this study, therefore, is to shed light on pedagogical implications related to the modification of textbooks in the TGS context. Specifically we are looking at ways to increase ESL students' CALP by modifying 4th and 5th grade math textbooks titled Everyday Mathematics (Bell et al., 2004a, 2004b) and in so doing to explore issues and processes related to this endeavor. With this purpose in mind, the research questions addressed in this study are as follows:

1. How effective is the Teacher Study Group context for modifying textbooks?
2. What central issues and challenges emerged throughout the process of textbook modification?
3. How do the modified math textbooks help English language learners enhance their academic language skills?

II. LITERATURE REVIEW

1. Content-Based Instruction

Cummins (1989) made a distinction between BICS (Basic Interpersonal Communicative Skills) and CALP (Cognitive Academic Language Proficiency). In a similar vein, Hakuta, Butler, and Witt (2000) claim that although ESL learners can develop functional or peer-appropriate conversational skills within approximately two years of initial exposure, it takes close to five years to develop academic proficiency in English that is on par with that of native speakers. Cummins further noted that the opportunity for language minority students to develop academic language ability should not be delayed until they are proficient in English.

Moreover, Harper and de Jong (2004) indicated a misconception that social language skills are commonly developed earlier than academic language skills. This study showed that older learners, who have already developed their academic foundation in their native

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language, may master academic language skills more quickly. As they have greater cognitive skills, they are better able to navigate the abstract concepts in school textbooks (Spada & Lightbown, 1993; Swain, 1995).

According to Echevarria and Graves (1998), the sheltered instruction model is a teaching approach which helps ELLs (English Language Learners) to understand the content of a subject area by employing various strategies while simultaneously promoting their English language development. For instance, a sheltered pre-algebra class can be delivered by an ESL teacher or a mathematics teacher in a classroom consisting of native and non-native speakers. By supplying comprehensive reviews of key vocabulary, teachers can regularly give feedback to students and conduct assessments of student comprehension. According to Echevarria, Vogt, and Short (2000), the SIOP (Sheltered Instruction Observation Protocol) components can be delivered by English as a New Language (ENL) teachers in a mixed class of native and non-native speakers to enhance ENL learners' content knowledge. Park (2010) explores how content based ESL instruction is similar and different from regular content-area literacy instruction and claims that CBI could be more effective for ESL students. ESL teachers can also combine language and content objectives systematically into the curriculum by transforming the academic English to enhance content knowledge of their English learners.

2. Textbook Modification

There are various studies about the effectiveness of textbook modification. VanPatten (1990) pointed out that ESL learners need to work with comprehensible academic language without explicitly attending to the relationships between the forms and functions of L2. It is both content and language teachers' responsibility to cater to ESL learners' specific needs in order to make content knowledge more comprehensible and accessible to them. The problem, however, is that standard textbooks are written without consideration for ESL learners' needs. Thus, in order to appropriately prepare ESL students for mainstream classes, language teachers should recognize the need to modify mainstream textbooks. The goal of textbook modification should be to enhance students' competence, self-confidence and motivation as it is these qualities that will transform students into active learners.

Graves (2000) suggested three factors that teachers should consider in adapting a textbook. First, teachers should be aware of their own beliefs and understandings about language learning before making decisions about what to add or what to change. Second, teachers should pay attention to students' needs, interests and certain expectations. Third, teachers should take into account the institutional context in which they are teaching as

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that context may provide some guidelines or even constraints that may influence the way in which they modify the text. According to Kern (2000), there are cases where text simplification is desirable. This may be especially appropriate in the early stages of language learning as a way to boost learners' motivation and to broaden the scope of their reading. For example, one way of increasing comprehension is by clear and consistent use of terminology throughout the text. In a similar vein, Ko (2012) investigated the effectiveness of glossing and second language vocabulary learning and revealed that L2 learners preferred glosses in their L2 reading materials.

On the other hand, Pica, Young, and Doughty (1987) claims that helping second language students does not mean compromising content by simplifying grammar or vocabulary, selecting simplified readers, or doing away with textbooks altogether. They claim that simplifying language input is less effective in improving ESL learners' comprehension than providing them with the opportunity to ask questions and clarify their understanding of the original version of a text in an interactive context. Oh (2001) compared the effectiveness of the simplification method and elaboration method of content instruction in Korea. The results of that study support that elaboration is more effective than simplification and that elaboration can promote fluent reading of original texts.

Generally, previous studies remain presenting statistical figures between the modified textbooks and students. Moreover, it is difficult to determine which type of modification is the most effective for ESL learners in previous studies. The present study depicts the process of the math textbook modification for ESL students, containing various opinions from teacher-researchers, an ESL teacher, a math educator and students. In this way, the study supports the importance of the triangulated textbook modification which language and content teachers (experts) are involved in, rather than a discovery of the most effective modification method.

For language minority students, content area textbooks, sometimes, may be a difficult obstacle, rather than a helpful resource. These students' language problem can be misconceived by a content area teacher as a student who has deficient cognitive skills in an academic area or as a student who is lagging behind. This is a serious matter for many ESL students to adapt to a new environment and is connected for them to form positive identities in formal education curriculum. These language minority students need safe places or ways to negotiate conflicting identities without a penalty. Canagarajah (2004) calls these places or ways as safe houses.

Earlier Pratt (1991) defines safe houses as "social and intellectual spaces where groups can constitute themselves as horizontal, homogeneous, sovereign communities with high degrees of trust, shared understanding, and temporary protection from legacies of oppression" (p. 40). In institutional contexts, like a school classroom, safe houses are

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usually unofficial and closet literacy but they have flexible and various ways to express (Canagarajah, 2004). Suh and Jung (2012) claims that American TV cartoons play a role of safe house for ESL young learners to adopt themselves to the new English speaking school. According to Canagarajah (2004), one of important roles of safe houses is to give language minority students important chances to practice academic terms with relatively negotiated expression. In this sense, we believe that modification of content textbook can be one way of safe houses for ESL students. It provides permitted nonacademic terms within authentic textbooks and a small relief in struggling minds in the mainstream. In other words, content textbook modification would be not only language support but also emotional support to ESL students.

3. Teacher Study Group

Research findings support that professional growth can be expanded when learning is perceived as a cooperative endeavor, but inhibited without continual interactions among teachers (Gallagher & Ford, 2002). Also, creativity and innovative thinking can be derived from the dynamic interaction among members of a community through collaboration (John-Steiner, 2000). A Teacher Study Group (TSG), for instance, is a collaborative group managed by teachers who focus on researching a common issue through interaction with others and strengthening their professional development (Cramer, Hurst, & Wilson, 1996).

Clair (1995) examined mainstream classroom teachers' professional development needs. They were asked about what kinds of development opportunities they needed in order to deal effectively with ESL students. She found several weaknesses within many pre-service teacher education programs such as traditional one-shot staff development workshops. Accordingly, she suggested that a teacher study group can be a way of ongoing professional development for ESL teachers as it allows teachers to critically reflect and pose problems to develop their own professional knowledge. Clair (1998) claimed that TSGs represent a radical change from the teacher as receiver to the teacher as creator of information.

Moreover, Cramer et al. (1996) noted that within teacher study groups teachers are able to gain autonomy and grow professionally by building communities of learners. They also emphasized the importance of teacher collaboration in TSG because teachers share new ideas and are encouraged to try new techniques through interaction with others. Through communities of learners built within TSG groupings, teachers are able to network and promote greater exchange of ideas (Short, Giorgis, & Richard, 1993).

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III. METHODOLOGY

This project took place in an elementary school setting with the help of a local ESL teacher. Five graduate students at a mid-west university, USA, at the time of this study participated in the project. Three of them used to be in-service teachers at secondary school or university and had teaching experience as English teacher for more than ten years. We were expected to modify the grade 4 and 5 math textbooks such that it would be easier and more comprehensible for the newcomers in the ESL class. More specifically, we were given two math textbooks, one for grade 4 and the other for grade 5 which were used in the ESL class, and we were asked to modify two chapters from each grade textbook. The ESL teacher provided some guidelines as far as use of pictures or symbols, simplification of directions, and, if necessary, deletion of questions containing long difficult phrasing that would be difficult for newcomers to understand. In addition to following the guidelines as much as possible, we utilized several techniques and methods over the course of this project: TSG meetings, interview with a math professor, a sample focus group test and interviews, and personal learning logs. The project lasted for four months from September to December, 2007.

1. Assigned 4th and 5th Grade Math Textbook Modification

Our first step was to meet a local elementary school ESL teacher, Ms. Feller. She introduced us to the 4th and 5th grade math books which were used at her school. She explained to us how she taught and helped ESL students with the books and why they needed modified textbooks, especially for newcomers. She usually explained the parts with which students struggled, but she often realized that the students would be better served by modified math textbooks. Therefore, we decided to help the ESL teacher by modifying the existing textbooks. After being getting a sense of the variables that the teacher wanted us to consider in our modification, our team began to work on our modifications. More specifically, we inserted pictures, provided additional examples, underlined key words, used arrows, paraphrased, used easier terminology, added a glossary defining key concepts, and eliminated complicated questions. The representative modification examples are provided in Appendix A.

2. TSG Meetings

As briefly mentioned above, in the first stage of this study, our team met with a local ESL teacher and discussed her challenges in teaching ESL students. Through informal conversations, we reached a common interest in mathematics textbook modification

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since it was widely held that math is the easiest subject for their ESL students to study. Therefore, we decided to form a TSG to explore the task of textbook modification for ESL learners as a personal and professional learning project. Since that point we have worked in a collaborative manner to achieve an effective method of modifying elementary math textbooks for ESL learners. As a result, we have formed a supportive learning community as we collaborated and engaged interactively in building up our professional development.

More specifically, during the project, our TSG team met four times, once a month. After each modification session, we had a TSG meeting to share ideas and discuss problems and difficulties as well as to arrange future plans. In these regular meetings, we shared the work that we had each done since our last meeting and also sought input about difficulties that we could not resolve individually. In this way we were able to brainstorm ideas and find appropriate solutions to the problems that would occasionally surface over the course of the project. Moreover, frequent email communication proved to be another collaborative tool as it allowed us to keep abreast of developments and concerns in an efficient and timely way.

3. Interview with a Math Professor

After the first round of modifications that we completed, we sought the advice of Dr. Jung, a Ph.D. in elementary school math education at a mid west university, USA. One of the members introduced him after realizing that we need an expert's specialized comments. He earned his doctoral degree in the field of teaching mathematics to young children and had experiences in teaching elementary school children and being involved several projects related to math education. He was employed as a professor at a university in USA at the time of this study. In an official interview, Dr. Jung gave us useful suggestions and emphasized the importance of conducting a sample group test. Though the advice that the education expert offered was useful, it also raised several critical questions that will be further discussed in the findings section of this paper.

4. Sample Test and Interview with a Focus Group

Following the math education expert's suggestion, we conducted a sample group test in order to closely examine the effectiveness of our modifications for ESL learners. For this purpose, we selected five 4th grade volunteers from a local elementary school—all of whom were Koreans. The group consisted of one male and four female students. All of the volunteers had had ESL experience or four of them were in ESL courses at the time of the study. The students were given 30 minutes to solve the questions provided.

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Following the completion of the test, the students were interviewed about their views on the modified material using a specially made interview questions (see Appendix B).

5. Personal Learning Log

In order to track our activities and discussions, each member of the TSG kept a personal learning log in which events and personal reflections were recorded. Chamot (1995) recommends keeping a journal in order not only to record ideas and impressions that are at risk of being forgotten, but also to track the emergence of research questions and insightful ideas. These documents present each team member's personal feelings and insights over the course of the project. The logs proved to be useful sources of discussion in our TSG meetings as they allowed each member to recall their ideas and opinions and to share these with others. Furthermore, we believe that these records may be useful to teachers and researchers interested in text modification, content area vocabulary development or individual tutoring.

IV. FINDINGS

1. Collaboration and Problem-Solving through TSG

During the modifications of the math textbook, there were several issues that proved to be sources of discussion within the TSG. A central issue that emerged had to do with the best way to balance the suggestions we were receiving from professionals whose advice informed our study. In particular, we endeavored to find a desirable way to balance and reflect the comments from both the ESL teacher and the math educator through discussion in TSG.

More specifically, the first challenge of the math textbook modification we faced was related to the glossary. For example, in the text glossary, the term 'rate' was given several different meanings and consequently each member of our group used the term with a different understanding. To avoid confusion, we implemented a math dictionary to ensure consistency in the terminology that we put forth in the text. Furthermore, based on Ko (2012) which claims that "input modification is a pedagogical intervention in which a teacher manipulates a target form to help learners acquire the form (p. 57)", we manipulated many of the definitions in the glossary so as to aid students' comprehension.

Aside from composing a simplified glossary and verifying the use of terminology, our TSG collaborated on making the symbols, pictures, and directions consistent in order to

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maximize the clarity of our modifications. We also collectively decided to eliminate a question containing wording that was deemed too advanced for ESL students.

2. Challenges from Suggestions by ESL Teacher and Math Expert

Despite our extensive exchange of ideas and collaboration, our TSG needed input from an education expert in order to get feedback about the effectiveness of our modification. For this reason, we organized a meeting with Dr. Jung. While the advice that we received from Dr. Jung was extremely practical and useful, we found that it often contradicted the suggestions that we received from the ESL teacher, Ms. Feller, with whom we had been working closely. This led us to conduct an additional sample focus group test and a subject interview.

Specifically, the math educator advised us to consult an elementary school math glossary through reliable sources or additionally the guidelines provided by the state department of education in order to include consistent and accurate terminology throughout our modified text. As we began to compile all of our individual work into one cohesive text, we often faced the challenge of consistency. For example, one member of our group defined the term 'label' as 'name' while another member selected an alternate definition. To avoid such inconsistent terminology use, we benefitted from Dr. Jung's advice by consulting reliable external sources such as math dictionaries.

Secondly, our TSG agreed on the fact that it would be better to withhold certain information so as to promote individual problem-solving skills among the students. For example, in the question 'what is the value of phi (π) to two decimal places?', we provided the students with the information that $\pi = 3.14$ underlining 14 and drawing an arrow from the part of the direction 'two decimal places' to the number 14. By directly indicating the two decimal places, students would be able to answer the question accurately. However, the math educator suggested that we use another decimal number to avoid giving too much information by duplicating the answer and in so doing to guide students to think about the answer by themselves. In other words, we should take care not to block the process of students' problem-solving skills by providing too much information. Rather than providing hints about how best to solve the problem, Dr. Jung suggested that we focus more on conveying the meaning of the problem and in so doing to maximize the amount of opportunities where students could improve their own problem-solving skills.

At this point in our research, we faced a dilemma as our TSG had to balance two sets of opinions regarding the rationale for the modification. The ESL teacher advised us to include examples of each question by showing sample solutions but the professor insisted that it was important to motivate the students to solve problems by themselves.

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These suggestions represented two contradictory needs of the ESL students. On one hand, we could help the ESL students by providing direct examples thereby lessening the linguistic burden of the problems; on the other hand, we could help the ESL students by giving content-based instruction by omitting direct hints.

Ms. Feller's suggestions regarding the inclusion of as many direct clues as possible is based on her own belief that it is important to increase ESL learners' confidence through scaffolding both in language and content. Ms. Feller reported that ESL learners felt more confident in their math ability compared to other subjects due to the fact that math is generally less linguistically demanding. She further noted that it is especially important to raise students' perceived self-efficacy or self-confidence when they are trying to adjust to a new academic environment.

The seemingly dissimilar views of Dr. Jung and Ms. Feller led us to consider several additional questions over the course of our project. Some questions that we faced included questions to do with the most effective ways to help ESL learners through textbook modification. Additionally, our team considered whether a detailed, example-heavy modification would diminish students' problem-solving skills. Further, we ruminated about the best methods of building ESL learners' confidence by scaffolding both in language and content while at the same time promoting their problem-solving skills.

In addition to the issues to do with the philosophy behind our modifications, we also needed to focus on detailed aspects of our work. Dr. Jung had advised us to pay close attention to the way that we utilized pictures and symbols throughout the text. As we included these features in the text with the goal of activating students' background knowledge, it was of utmost importance that these worked in a consistent way throughout our text. Thus, we needed to agree on specific pictures to use for each concept in an appropriate and consistent way. For example, to demonstrate a concept such as 'area' and 'shade', most of us drew a picture of slanted lines in a box. While our drawing reflected our own ideas regarding these terms, the concepts of 'area' and 'shade' bear an alternate meaning in mathematical discourse.

Finally, we needed to refer to the American national math curriculum in order to make sure that our modification fit in with the curriculum goals and design. Accordingly, Dr. Jung suggested that we check the principles and standards for school mathematics while we were in the process of modifying our textbooks. He pointed out that National Council of Teachers of Mathematics recommends that math classes should be more student-centered and that teachers should provide opportunities for students to use conjecture, intention and problem-solving.

Ms. Feller further elaborated on the issue of national approaches to educational goals. She related that different countries approach math education from different standpoints.

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The approach to math in the USA is different from, for example, that in Korea or Japan in terms of the style of learning. The math textbooks that are used in the state subscribes to an independent learning approach which aims to have students consider math problems in many different ways and engage with the material in a meta-cognitive sense rather than memorize factual information. Therefore, English language learners may have more difficulties in math due to the use of different or unfamiliar approaches to learning in the classroom as well as their limited language proficiency. Furthermore, as each student has a different learning style, choosing only one approach posed a unique challenge to our team. Ms. Feller's practical and insightful feedback enabled us to recognize the complexities of math education instruction in the USA as well as the unique struggles with which ESL students are faced in that academic milieu.

3. Small Sample Group Test and Interview

After the meeting with the math educator and getting feedback from the ESL teacher, we decided to do a sample focus group test and interview students to validate the text modification and to clarify the focus of our modification. Doing test and interview allowed us to verify the efficacy of the approaches we had experimented with in our modifications.

The participants for our focus group consisted of 5 elementary school students all of whom were originally from Korea. The group contained 1 male student and 4 female students and all of them were fourth graders at the time of this study. The male student had been in the US for nineteen months, two female students for seven months, one female student for thirteen months, and the other for fifteen months. The male student was the only one in the group not currently taking an ESL class. They were asked to solve math questions with the fourth grade modified text for 30 minutes, and after the test, they were interviewed about difficulties they had in math class and their thoughts about the modified math texts.

More specifically, for the question of "Do you have difficulties because of English in your math class?", all interviewees said that they had problems in comprehending the directions and glossary. The boy who was not in the ESL class said that if he did not know words in solving math questions, he referred to the Student Reference Book or one of the dictionaries available to him. Interestingly, one girl who had been in the USA for seven month mentioned she felt little burden from the language in math because of pictures, symbols and prior knowledge. She felt more difficulty when she encountered unfamiliar words in her social studies class.

When asked about the usefulness of our modified text, the three girls agreed that it was helpful, but the boy and one girl rated it as somewhat helpful. In other words, the

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students felt that the modified textbook was generally useful in helping them solve math problems.

As for the most useful types of modification, four of our subjects reported that the pictures were helpful. Further, one girl mentioned that the glossary of math terms as well as the hints concerning measurement units (for example, 1 pound = 16 ounces) were most useful to her. In addition, three children mentioned that the modified or simplified directions, use of arrows, examples, and simplified words were helpful to them.

The students also pointed out several items for our consideration. In their comments, the students mentioned the importance of avoiding confusing pictures and confusing directions. They wanted more concrete and accurate pictures. They reported that some pictures, directions, handwriting, and circling were confusing. They also wanted more examples such as math formulas necessary to solve different problems. In addition, the students wanted not only easier, more concrete and simplified directions, but also more simplified explanations in the math glossary. Finally, one of our interviewees said she read original directions as well as the modified ones when the modification was confusing. Confusing modification can be distracting and even inhibiting, and that is why we had to be more cautious in doing revisions. However, in general, all of the interviewees found most of the modification techniques helpful. Two of our interviewees commented that the modifications would be more helpful for new comers in particular.

Although the responses of students were different depending on their language proficiency and math competence, our modification is still a useful tool for both students who already understand the directions as well as those who have difficulty with understanding directions. For the former, modification helps them confirm the meaning of the question. Moreover, it reduces the time needed to solve the problems. This is an important factor as time management during tests is important issue for ESL students. For the latter, our modification conveys the meaning of the directions for solving problems and fosters self-confidence along the lines of VanPatten (1990).

V. CONCLUSION

Throughout the entire process of textbook modification, we have found that there were many instances where a supportive learning community indeed enhanced teacher collaboration within our TSG. We worked very closely by giving each other ideas, tips, feedback and suggestions through formal as well as informal meetings. In particular, email correspondence was especially valuable as a channel of communication for our TSG. This type of communication also enabled us to receive useful feedback both from Ms. Feller and Dr. Jung who continuously guided us by providing useful suggestions

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throughout our project. Email was instrumental in helping us maintain ongoing dynamic interaction and collaboration as it was conducive to the expression of informal opinions on unexpected issues which surfaced during the process.

Lave and Wenger (1991) pointed out that when a group of people work together continuously for a period of time, the informal nature of collaboration becomes a central feature of that community. Moreover, when individuals interact and engage informally with one another, they are able to overcome the challenges resulting from "contrived collegiality" (Rhodes & Beneicke, 2002, p. 301). We believe that working within the TSG in a new field of textbook modification was a great opportunity for us to grow professionally and personally. The peer feedback that resulted from close collaboration proved to be a useful feature in revising our modification. By working in a group, we were better able to come up with a greater number of ideas about the incorporation of consistent and clear terminology in our version of the text. Overall, our experience working on this project confirmed the effectiveness of the TSG context in dealing with textbook modification.

On the other hand, the findings from the sample focus group test and interview with ESL learners show that in general, the students perceived the modification to be helpful. Moreover, some students believed that the modification helped them solve math problem with greater ease. It became evident that the modification was effectively scaffolding ESL learners in comprehending the math problems. The affective byproducts of the modification were increased motivation and confidence levels. While ESL learners face difficulties when confronted with academic English, they need to be exposed to it as early as possible in order to actively engage in an academic environment and to catch up to their native speaking peers. In this sense, modified materials may hold the key to helping motivate ESL learners to successfully adjust to American curricula. All these points taken together lead us to conclude that our modified math textbook appeared to be helpful for ESL learners by improving their problem-solving skills and building up their conceptual math terms as well.

The last inquiry of our research was related to the central issues and challenges that emerged throughout the process of textbook modification. Since it was the first time that our group members attempted to modify an authentic content text, we faced some unexpected difficulties. As the members worked apart, it was important to maintain a consistent pattern in the modification including a coherent form of symbols and formulas. We also needed to reach an agreement about the best method of simplifying the wording in the text. Short (1989) noted that successful materials adaptation is not about simplifying vocabulary and shortening sentences, "but adapting information to make it accessible to language minority students." (p. 4). She also indicated that 'watering down' essential information should be avoided and key technical terms must be retained

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because ESL students' ultimate goal is to achieve the ability to read standard textbooks. Accordingly, we had to be cautious about including modified vocabularies so as not to cause any confusion for ESL learners.

Additionally, our lack of content area knowledge in math proved to be a significant hurdle. To address this challenge, we frequently referred to the 'Teacher's Lesson Guide' to improve our background knowledge of the subject. Because we chose to cover two grade levels (grade 4 and grade 5), we were faced with many units and a broad array of topics. In retrospect, we would have fared better had we focused on only one grade level and one unit specifically such as fraction or geometry.

Moreover, the variance in terms of English proficiency among the ESL students who are likely to utilize our modification made it more challenging to select the appropriate level of difficulty of the wording in our modification. In addition to language proficiency, we also needed to consider student's varying abilities in areas such as problem-solving.

Our big dilemma had to do with the conflicting suggestions that we had received from the math educator and the ESL teacher. The math educator insisted that we should avoid including too many direct clues in our modification as that may hinder ESL learners' own problem-solving skills by decreasing the amount of opportunities for individual work. The ESL teacher believed that it is crucial to increase ESL learners' confidence particularly when they are trying to adjust to a new academic environment and that this can be done through scaffolding both in language and content. Within the framework of CBI, Swain (1996) claimed that "integration of content and language instruction covers all aspects of language knowledge and the four language skills" (p. 529). Snow, Met, and Genesee (1989) also pointed out that effective language learning can be promoted through the integration of language and content that provides meaningful social and academic contexts. They went on to emphasize that interesting and important content greatly motivates language learners because language learning occurs simultaneously with content learning. Thus, it is unlikely that language and content can be separated within the CBI model and as a result, it is not desirable for ESL teachers to provide scaffolding only for the linguistic aspects of the text. Moreover, our team was largely in support of the idea that greater attention needs to be paid to the affective aspect of the learning process as this will ultimately lead to greater confidence and academic success for ESL learners. Thus, we believed that the simplified directions included in our modification would boost rather than impede the cognitive processes inherent in problem solving.

Finally, there are several limitations related to this study. First, it would have been better served had we placed a greater amount of weight on the suggestions of the mainstream math teacher given that ESL learners encounter math texts in regular math class. The content teacher might have a different approach or perspective on

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modification and could have given us some additional suggestions. Moreover, in the context of CBI, it is essential for language teachers and content teachers to collaborate. In our study, we also found that the views of the ESL teacher and the math educator differed .While the former was more keenly aware of and placed greater weight on the daily struggles of her ESL students, the latter had a greater appreciation of educational policies and theories. Although the results of our sample focus group interview indicate that the ESL learners perceive the more concrete and direct examples to be helpful, which corresponded to ESL teacher's advice, the advice of the math educator is persuasive in light of long term educational goals. Therefore, ESL teachers and content teachers need to collaborate together in order to ensure that English language learners are able to develop both language proficiency and content knowledge in an appropriate way.

Second, our textbook modification was designed to act as a transitional tool that would eventually enable learners to comprehend unmodified or original textbooks. While we did not address the question concerning the length of time needed to transition from modified to original text, we believe this to be a worthwhile topic for future research.

In conclusion, we found it necessary to establish consistent, concrete, and comprehensible terms and examples throughout our modification material. We achieved this by providing pictures, glossary terms, and simplified directions and also by eliminating questions with tricky wording and extraneous information. Our revisions reflect the focus group test results as well as advice from both the ESL educator and the math educator. We believe our challenges and emerged issues throughout textbook modification suggest what both ESL teachers and content educators consider when they scaffold content knowledge and language proficiency of ESL learners. The concerns and limitations mentioned above should be carefully taken into account by future researchers interested in the topic of text modification.

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APPENDIX A

Math Textbook Modification Examples

1. Insert corresponding pictures for difficult words.



Question: An adult ostrich might weigh about ___.

a. 1.5Kg b. 15Kg c. 150 Kg



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2. Provide corresponding symbols for difficult words.

Question: Multiply.
↳ ×

3. Paraphrase questions with easier words.

Question: ~~Use the partial products algorithm.~~ *Show how you got your answer.*

4. Giving an example.

Question: Write four names for -214.

a. ex) -428-(-214) b._____ c._____ d._____

5. Providing easier words (or symbols) for difficult words.

Question: Make true sentences by ~~inserting~~ parentheses.
putting ↳ ( )

a. ex) (19 + 41) * 3 = 180 b. 5 = 16 / 2 + 2 - c. -1 = 16 / 2 + 2 – 5

APPENDIX B

Sample Interview Questions

1. Please give a description of yourself.
   Age: Gender: Grade: Length of stay in the U.S.:
2. Are you an ESL learner? If so, how long have you attended ESL class?
3. Were the modifications helpful?
4. How did you feel when you were solving the problems?
5. What types of modification were particularly helpful?
6. Do you have any comments or suggestions to make modifications more effective for yourself or for your friends?

Examples in: English

Applicable Languages: English

Applicable Levels: Elementary, Secondary

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Young-Mee Suh
Dept. of English Education
Ewha Womans University
52, Ewhayoedae-gil, Seodaemun-gu
Seoul, 120-750, Korea
Tel: (02) 3285-8972 CP: 010-6511-8972
E-mail: ymsuh012@naver.com

Ha Young Lee
Dept. of Literacy, Culture & Language Education
Indiana University, Bloomington
Tel: (051) 200-7041 CP: 010-2520-6567
E-mail: lee2@umail.iu.edu

Eun Young Park
Dept. of Literacy, Culture & Language Education
Indiana University, Bloomington
Tel: 010- 7714-1012
E-mail: park9@umail.iu.edu

Yoosun Jung
Seoul National University High School
Jongam-dong, Sungbuk-gu
Seoul, 136-090, Korea
Tel: (02) 583-8280 CP: 010-8280-0067
Email: yoursun86@hotmail.com

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