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The Relevance of Multiple Intelligences to CALL Instruction

In-Seok Kim
Dongduk Women's University

ABSTRACT

Many teachers and researchers believe learning preferences or learning styles can be used advantageously to enhance language study and motivate learners. Following an overview of Gardner's theory of multiple intelligences (MI) and research on multimedia-based approaches in foreign language instruction, this paper first describes a study comparing students' learning preferences, obtained through an MI inventory survey, to their listening scores before and after CALL instruction. The correlation between students' MI scores and listening scores is then analyzed, determining whether their MI was improved by CALL instruction, and if so, which MI and to what degree. This is followed by a discussion on how language learning software could be implemented to increase students' use of multiple learning styles. It is concluded that CALL software can be effectively used to enhance the many kinds of human intelligences employed when learning languages.

INTRODUCTION

All learners are endowed with different mind sets that they employ while performing various activities in their daily lives. These learning styles or learner strategies are believed by language pedagogues to be essential in deciding the success or failure of language learning (Reid, 1987; Oxford, 1993; Chamot, 2004; DeCapua & Wintergerst, 2005). This view has been largely documented in ESL/EFL literature. Working from the discipline of psychological education, Gardner proposed in the early 1980's the theory of multiple intelligences (MI) that all humans are born with different sets of intelligences and tend to excel in one area over another. When these two views are taken together, the principles of learner strategies can be viewed as not far removed from the MI theory: Learners have a priori propensities to utilize their inborn or acquired intelligences in their attempt to discover or learn new things, such as languages. What matters is how we can facilitate their new learning activities both in and out of the classroom.

Many multimedia experts believe that multimedia technologies can motivate students to learn languages better than without it (Thornburg, 1997; Cameron, 1998; Brett, 2000; Egbert & Hanson-Smith, 2007). This is one of the reasons why practitioners across the language curricula resort to Computer-Assisted Language Learning (hereafter abbreviated as CALL) instruction for

innovative language teaching, particularly with the advent of modern technologies over the last decade. Keobke (1998) addresses the issues in designing CALL for multiple language learning styles. He believes that students can learn languages best when programs are geared to their learning styles, which is not always possible in traditional classrooms. He advocates collaborative learning activities—easily provided by the computer—as the best way for learners to improve their language. Although there are some research reports examining the effectiveness of learner strategies and multiple intelligences in the multimedia-assisted language classroom setting (Po-Ying, 2006; Haley, 2004; Christison, 1999a, 1999b), nonetheless, there is a paucity of research on identifying the mutual relationships among them.

This paper sketches the theoretical underpinnings of the MI theory and the effectiveness of multimedia technology in the English language classroom. Beginning with a succinct review of the literature, it subsequently formulates three research questions and describes the procedure of an experiment that this researcher constructed. It then analyzes the data and discusses the issues involved in applying MI to CALL instruction. Finally, suggestions are made for future research to determine how best to utilize students' multiple intelligences to maximize CALL instruction in modern language classrooms.

THEORETICAL FOUNDATIONS

On the Theory of Multiple Intelligences

Gardner's (1983) theory of multiple intelligences (MI) proposes a means to understanding the many ways in which human beings are intelligent; that is, how we process, learn, and remember information, in contrast to the prevailing notions of intelligence testing, which posit a general, all-encompassing general intelligence. Gardner (1983, 2000) states that while individuals are capable of processing information in at least seven different ways (see Figure 1), each individual varies in the degree of skill possessed in each of these intelligences.

Figure 1. Seven Types of Human Intelligences (taken from Armstrong, 1999)

The seven types of MI are as follows:

1. **Linguistic intelligence** is our ability to speak to each other in our daily conversation, or write a letter to someone, or perform any verbal activity. This intelligence goes unnoticed because everyone unconsciously uses it so commonly.

2. **Logical-mathematical intelligence** is our ability to solve problems and meet new challenges. This type of intelligence is associated with scientific thinking, such as measuring the perimeter of the earth or predicting when an area will be hit by an earthquake. This intelligence is also tied to counting, as when checking change after making a purchase, or planning something for the future.

3. **Musical intelligence** is our ability to sing a song or chant to the tune of a radio melody. We often use this type of intelligence to alleviate stress, but musical intelligence may also make some students more attuned to accent and pitch in language study.

4. **Intrapersonal intelligence** allows us to be independent, appreciate time alone, and be self-reflective. Intrapersonal intelligence involves knowledge about and awareness of the internal aspects of self (Lazear, 1999), such as knowledge of feelings, thinking processes, self-reflection, etc. Study and homework performed in isolation are intrapersonal.

5. **Interpersonal intelligence** is expressed in our human relationships where we cooperate with each other or agree or disagree with each other. The trait of interpersonal intelligence is the most common intelligence foreign language teachers use. These include, but are not limited to, caring for others, communicating with others, empathizing and sympathizing with others, leading and organizing groups, resolving conflicts, seeing from another's point of view, and working as a team member. Kagan (2000) suggests that these skills can be activated by cooperative learning structures: *Think-Pad Brainstorming; Give One, Get One; Round Robin; Timed-Pair-Share; Fan-N-Pick; Blind Sequencing;* and *Inside-Outside Circle.*

6. **Bodily-kinesthetic intelligence** requires physical movement such as shoveling snow, painting pictures, dancing to music, or performing sports. Bodily-kinesthetic intelligence involves our ability to use the body to express feelings or desires. The Total Physical Response (TPR) approach to language teaching relies on the use of bodily-kinesthetic intelligence.

7. **Spatial intelligence** involves visualization of things or ideas, through which we can retain memories for a longer period of time. Visual-spatial intelligence enables us to grasp meanings better when they are traced with visual images. Nelson (2006) suggests that students synthesize and create new meanings when they combine visual images and text in, for example, digital storytelling activities.

Gardner's (1983) theory of multiple intelligences is not based upon binary attributes—either linguistic or logical-mathematical, as expressed in the IQ test formula prescribed by Binet (1916) and Binet and Simon (1916) and his disciples. However, Gardner believes that individuals may rely more heavily on one intelligence over another. Accordingly, foreign language teachers may help students learn better by tapping into one or more of the intelligences that an individual student might use dominantly. In the years since Gardner first published *Frames of Mind* (1983), research has connected multiple intelligences and learning styles (Kean, 2005), and multiple intelligences and learning strategies (Felder & Soloman, 1999). In particular, a number of articles have explored the possibility of applying multiple intelligences to the teaching of English to grade school students (Son, 1998; Kim, 2000; Boo & Choi, 2000). This research has shown that applications of MI theory have had a positive influence on learning English in class and enhanced students' interest in language learning. Likewise, a number of teachers and researchers (Kolb, 1984; McCarthy & McCarthy, 2005) treat MI as the basis for learning preferences or learning styles that can be used advantageously by teachers to enhance language instruction and motivate learners. (Subsequent to his initial work on MI, Gardner (1999) has spoken of moral and spiritual intelligences and other types of intelligences, which this paper disregards as being less easily definable as aids to language learning.)

Multimedia Technology and CALL Instruction

Digital technology has enabled multimedia to be an important part of our lives and has become an integral part of the educational profession in the 21st century. We have seen multimedia applications (for example, on CD-ROMs, Web pages, laser videodisks, etc.) make a great impact on foreign language learning. Computer-based multimedia is a very appealing tool for education since it can deliver combinations of text, sound, graphics, still images, animations, and video. Multimedia can, if properly used, make a great impact on foreign language learning since each media element has its own particular advantage in conveying different kinds of messages and evoking various kinds of learner responses (Brett, 1996).

There is a great deal of research examining whether multimedia is effective for language learning. Brett (1998) summarizes the most important perspectives from which to view the effectiveness of multimodality: intuitive, second language acquisition theory, and empirical research. From the intuitive perspective, Brett argues that the power and effectiveness of adroitly aligned multiple learning media should be greater than the sum of their individual parts. The second perspective, second language acquisition theories (such as input theory, noticing, motivation, and autonomy) are well documented in the body of SLA literature. His third perspective is rooted in the findings of empirical research that examine the effectiveness of multimedia language learning programs (Liu & Reed, 1994; Chun & Plass 1996; Grezel & Sciarone, 1994; Brett, 1996, 1997, 1998). His review of the literature strongly supports the claim that multimedia-assisted language instruction has proven to be more effective than non-media-supported methods of language teaching.

As concerns MI theory and practice, an increasing number of educators have discussed the practical application of MI in foreign and second language classrooms (Kolb, 1984; McCarthy & McCarthy, 2005; Nelson, 2006). In particular, Christison (1998a, 1999a, 2005) has worked extensively on integrating MI theory into second/foreign languages classroom teaching. Her body of work includes a taxonomy of language-learning activities of multiple intelligences, a

TESL/TEFL MI weekly syllabus, the creation of MI-based lesson plans, examples of four stages of information processing, and an MI assessment. Other research (Christison, 1999b) describes how MI theory can be applied in teaching English as a second language to adults. She recommends first identifying adult ESL students' strengths and learning preferences and then allowing them to employ appropriate MI strategies in language learning. She states that students are likely to become more engaged in learning as they use learning modes that match their intelligence strengths. Berman (1998, 2001) exemplifies the variety of hands-on exercises and activities available for each type of intelligence in the MI theory. Another study comes from Halley (2004) whose work with a large number of K-12 students indicates that students achieve greater success when MI theory was implemented in classroom teaching. Currie (2003) addresses a dire need for ESL teachers to identify their students' strengths and weaknesses in order to make a greater impact on their language learning. She argues that teachers should encourage students to use their strengths, which can be identified by giving a simple MI questionnaire, in order to make the learning process more accessible.

A similar story comes from numerous articles on MI-based teaching with computers. Dryden (2004) offers a thorough explanation of MI theory and interprets CALL in light of the theory. He holds the view that CALL offers something for nearly everyone because multimedia, as seen in hypertext on CD-ROMs and the World Wide Web, integrates several intelligences and allows them to support each other. He further believes that the enfranchising power of CALL and MI theory will transform the ways we teach in schools by bringing a new curriculum adaptable to each student's needs in the 21st century. Another recent research paper in a similar vein is Stedge's (2005) article describing how she designed her French long distance learning course in tandem with the theoretical underpinnings of MI theory. This research merits our attention in that she used videoconferencing to teach French online. She believes that videoconferencing or steaming video can naturally help to further the use of MI theory for the benefits of nontraditional learners, especially for poor readers and writers. Her belief relies on Trotter's (1993) strategies that emphasize collaboration, independent thought, creation, and exploration. These four ways of learning with others comprise MI theoreticians' stock in trade, and they, in turn, represent the essence of what learners can do with multimedia.

As concerns student attitudes, Chen (2003) reports students' positive reactions to CALL instruction. He asked students to practice English, using the *Tell Me More* CD-ROM for one hour per week in a weekly three-hour course. Students' questionnaires at the end of the second semester revealed that the use of courseware enhanced their pronunciation, conversation, and listening abilities. Chen's (2004) ensuing research reports the use of MI theory in large computer-assisted EFL college classes in Taiwan. In this research, he taught students for one hour with technological activities in English in a multimedia classroom and with reading, writing, and discussion for two hours in a regular classroom. At the end of the course, he asked students to present their reading activities from the textbook through multimedia, using six types of intelligences. He reports students' high motivation as well as intense affective responses. This experience assured him that the collaborative pedagogy essential to MI theory and multimedia had proven to be effective in promoting individualized and student-centered learning.

Turning to curriculum design, Mackenzie (2002) demonstrates how educators can harness the power of technology in their instructional planning. He believes that the integration of multimedia technology into the classroom needs no longer to be a hit-or-miss proposition. He compares MI with non-digital technologies to MI with digital technologies to demonstrate the

unprecedented change in the landscape of technology in the educational environment over the last 30 years. *Teaching and learning through multiple intelligences* (Campbell, L., Campbell, B., & Dickinson, 2004) is a seminal work in integrating MI into teaching languages. This book offers practical classroom applications of the MI theory, and includes ample resources for incorporating MI into the teaching of languages through multimedia technology. More extensive resources for teachers can be found at the *International Society of Technology in Education* (ISTE) Website (www.iste.org) and Riverdeep's *The Learning Company* (www.riverdeep-learning.co.uk). The ways in which MI may be enhanced by computer-assisted instruction, as proposed by these various works, are summarized in Table 1.

Table 1. MI Enhanced by CALL Activities

Intelligence	CALL Activities
Linguistic	keyboarding, practicing language skills with interactive software or on Websites, using word processors, using spelling and grammar checkers, creating multimedia reports, writing and reading email, text and videoconferencing, using speech recognition devices, using a concordancer, using translation software or Websites, using the Web for research
Logical-Mathematical	using software or Websites with brain teasers, puzzles, games of logic, etc.
Spatial	playing card games, using graphics programs, learning with pictures on CD or DVD or with video clips on the Web, using presentation software, creating videos or digital storytelling products
Bodily-Kinesthetic	playing computer games, using TPR-based instructional software, using simulation software or virtual reality environments on the Web
Musical	listening to and interacting with songs on software or on the Web, composing digital music live or on interactive Websites
Interpersonal	using email, text or voice chatting, using cell phones and PDAs, engaging in computer-supported collaborative learning (e.g., e-pals or the GLOBE project)
Intrapersonal	using intelligent tutoring systems, using speech recognition devices, using news groups, meta-cognitive journaling or blogging, using mind-mapping software or Websites, learning about computers using software or Websites

In sum, all previous research points to symbiotic interdependency between MI theory and multimedia-assisted CALL instruction. Probing this relationship was the focus of the investigation presented next.

RESEARCH METHOD

Research Questions

In the previous section, we have seen the relationship between MI and multimedia technologies used for language instruction. Based on this literature review of MI theory and multimedia CALL instruction, three research questions concerning this relationship were proposed:

(1) To what degree does CALL instruction increase students' listening scores?

(2) Does CALL instruction improve students' MI inventory scores and, if so, which type of MI quotients will increase the most?

(3) Which particular type of intelligence correlates most highly with listening ability?

Methodology

Subjects

Thirty-nine juniors and seniors majoring in English Language and Literature at Dongduk Women's University participated in the experiment. These students, averaging 22 years of age, were enrolled in the 16-week multimedia technology-assisted language course that this researcher taught in the Spring semester of 2006.

Instruction and Testing

Pre-test

During the first meeting of the class, students took the Test of English for International Communication (hereafter abbreviated as TOEIC) listening test (Part I and Part II, 50 items) to determine their general listening abilities. Students were also given a Korean MI questionnaire that the researcher modified from existing MI inventories (Christison, 1998a; Armstrong, 1999). This questionnaire consisted of ten sections, eight items per section. (In addition to querying the seven intelligences described earlier in the paper, the researcher included an eighth, *Natural intelligence,* proposed in Gardner's (1999) later work; these results were negligible and are not included in this study.) All items were chosen at random to disguise their nature. Students were asked to mark 5 (strongly agree), 4 (agree), 3 (undecided), 2 (disagree), or 1 (strongly disagree) for each item in the questionnaire. The MI questionnaire translated into English from the original Korean version appears in Appendix A.

Provision of CALL Instruction

In accordance with the weekly syllabus found in Appendix B, the researcher taught from March 2 to June 16 of 2006 a general English course covering elements of all essential language skills (i.e., reading, writing, listening, speaking, grammar, and vocabulary). The course syllabus consisted of sixteen weeks: fourteen weeks of teaching and two weeks of exams.

Allocation of Instructional Time

Though the course content was distributed over different class time allotments, no class time was allotted to teaching the Bodily-kinesthetic or Musical intelligences as seen in Table 2. The researcher had to allocate different amounts of time to teaching with a focus on different types of intelligence due not only to the course objectives but also to the resources available. In determining the class time allotment, the researcher analyzed the contents of materials from his CALL instruction for each class period and calculated the amount of time spent on CALL instruction linked to each type of intelligence. For example, the class time spent on each intelligence ranges from 40% for Linguistic, 20% for Spatial and Intrapersonal, and 10% for Logical-mathematical and Interpersonal intelligences respectively. The class time spent on the Bodily-kinesthetic and Musical intelligences was zero since they were not included in the course syllabus.

Table 2. Class Time Allocation

Type of Intelligence	**CALL-Based Activities**	**Class Time (%)**
Linguistic	lectures, small discussions, worksheets, memorizing, using word-processors, listening to sounds and recording their pronunciation, quizzes	40
Spatial	videos, animations, pictures, visual awareness techniques	20
Intrapersonal	computer-assisted training, word-processing classroom assignments, individual project, goal setting	20
Logical-Mathematical	logical and sequencing presentations, logical guessing, word problems, puzzles, games	10
Interpersonal	group discussions, pair work, group brain-storming	10
Bodily-Kinesthetic	None	0
Musical	None	0

Post-test

At the end of the course, students were given the same 50 items TOEIC listening test to determine any increase or decrease in students' general listening abilities when compared with their test before the course started. Students were also given the same MI questionnaire to compare with the result of the first MI questionnaire they took at the beginning of the course.

RESULTS

The two sets of TOEIC listening scores and MI inventories were entered into the SPSS for Windows (SPSS, 2005) program to address the two research questions under investigation. The first question was whether the researcher's CALL instruction would increase students' listening scores. The mean and standard deviation (SD) of students' listening scores are shown in Table 3.

Table 3. Mean and Standard Deviation of Listening Scores

N = 39	Mean	SD	P level
Before CALL Instruction	28.38 (50)	5.348 (50)	<0.000
After CALL Instruction	32.61 (50)	5.178 (50)	

The students' TOEIC listening mean score is 28.38 on a scale of 50 maximum before CALL instruction and 32.61 thereafter. The difference between these two scores is deemed significant at the $p<0.05$ level. Thus, one can say that students' listening scores improved during CALL instruction. However, it may not be possible to argue that CALL instruction was more effective than non-CALL instruction since this course was not compared with a similar non-CALL instruction course.

The second question investigated whether CALL instruction would improve students' MI quotients, and if so, which type of MI quotients would increase the most. Table 4 shows the mean scores and SDs of all types of MI before and after CALL instruction.

Table 4. MI Quotients before and after CALL Instruction

N = 39	Before	After	Paired T-test Results			
			Mean	SD	T-value	P level
Mean	2.02	2.24	.224	.199	7.04	.000
SD	.37	.40	-	-	-	-

The average of the seven MI quotients combined is 2.02 before CALL instruction, but increased to 2.24 thereafter. This difference (.22 increase) is statistically significant at the $p<.05$ level. Thus, it reasons that CALL instruction has improved students' MI quotients in general.

Considering which type of MI has improved most or least, Table 5 shows the mean score and SD of each type before and after CALL instruction. The maximum score for each type before or after CALL instruction was 5 points.

Table 5. Mean and Standard Deviation of Each MI Type after CALL Instruction

MI Type	Before (maximum 5 points)	After (maximum 5 points)	Paired T-test Results			
			Mean	SD	T-value	P level
Linguistic	1.97	2.25	.279	.301	5.798	.000
Logical-Mathematical	1.68	1.94	.261	.331	4.929	.000
Spatial	2.00	2.29	.284	.389	4.561	.000
Musical	2.18	2.33	.158	.342	2.904	.006
Bodily-Kinesthetic	1.85	2.00	.138	.395	2.185	.035
Interpersonal	2.22	2.47	.226	.333	4.277	.000
Intrapersonal	2.58	2.79	.212	.338	3.922	.000

Table 5 shows that the mean scores of all seven MI types have improved following CALL instruction, albeit to varying degrees. For example, the mean score of Linguistic is 1.97 before CALL instruction and increased to 2.25 thereafter. The difference between the two is .279 and its SD is .301. This difference is statistically significant at the level of $p<0.05$. It should be noted, however, that the degree of improvement following CALL instruction varies. Figure 2 shows the mean score increases of the seven MI types following CALL instruction in descending order. The points on the left indicate the increase of MI Quotients following CALL instruction.

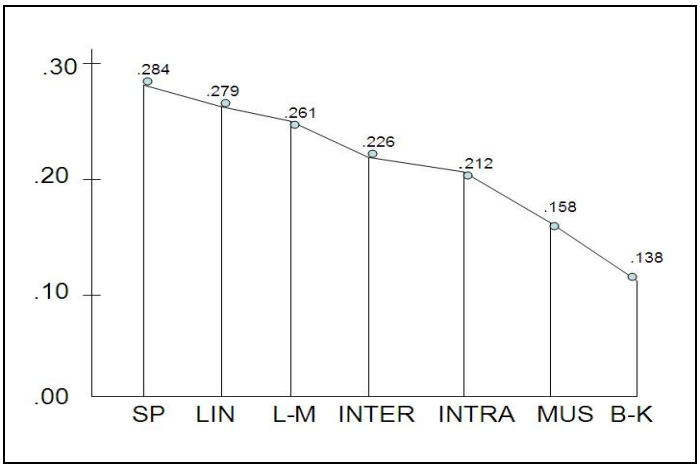
As seen in Figure 2, the score improvements can be divided into three groups. The first group consists of Spatial, Linguistic, and Logical-mathematical. The relative high score improvement of the three MI types in this group appears to be closely related to CALL instruction, because these first three MI types were essential elements of this researcher's syllabus and teaching approach. In fact, CALL instruction in this class heavily relied on visually-driven language materials (e.g., pictures, sounds, animated figures) for Spatial stimulation, intensive Linguistic practice (e.g., repetition, role-play, pronunciation practice, pair practice) in the course of language study, and thinking skills development (e.g., paragraph sequencing, guessing games, word problems) for the Logical-mathematical side. These were all performed on computers.

The second highest group consists of Interpersonal (22.6), and Intrapersonal (21.2). The score improvements in these two intelligences were expected since the technology-based instruction entailed some degree of these two elements. For the former, students were given frequent opportunities to practice language in pairs, in groups, and through role-play. These activities were completed without computer-assistance. For Intrapersonal study, students practiced language using individually assigned multimedia programs running on the computer for ten to fifteen minutes of each class period. This practice included talking to the characters on the screen using paired branching dialogue techniques, answering comprehension questions after watching a video clip, grammar and word study with pictures, and pronunciation practice using

an automatic sound recognition system. Thus, one may expect scores in these areas to improve to some degree.

Finally, the third group consists of the two remaining types: Musical (15.8) and Bodily-kinesthetic (13.8). Though the score improvements of these two types are relatively low, the result is not surprising since these two elements were not included in the CALL instruction. But one may still wonder how the quotients of Musical and Bodily-kinesthetic increased, albeit low, without any instruction on them. It is plausible to surmise that students might have gained this low score increase from outside activities not related to CALL instruction provided for them in class. This then would emphasize the point that the increases of the quotients of these two types of intelligences, though not explicitly included in the CALL instruction, were not higher than the other five types of intelligences included.

Figure 2. Degree of Score Improvement following CALL Instruction



The third research question sought to investigate whether there would be any correlation between students' listening scores and their MI quotients before and after CALL instruction and, if so, which type of MI quotient would correlate most highly with listening ability. The mean scores and SDs of each MI type are shown in Table 6.

Table 6. Correlation between Listening Scores and MI Quotients

Listen	LIN	L-M	SP	MUS	B-K	INTER	INTRA	Mean	P level
Before	-.125	-.185	-.115	.045	-1.141	-.056	-.143	-.122	<0.05
After	-0.11	-.150	-.069	-.044	-.163	-.053	-.188	-.130	<0.05

Table 6 shows the correlation ratios are extremely low or negative between the listening scores and the seven MI types both before and after CALL instruction. This result is unexpected since it counters the researcher's original prediction that CALL instruction would yield some degree of correlation between listening scores and MI types following CALL instruction. The

result of low correlations like these is interesting since Table 1 shows a significant increase in listening scores following CALL instruction. The lack of correlation between these two variables might have something to do with the nature of the MI types measured in this study. In other words, the MI types might be too generalized to show noticeable correlations to specific language skills such as listening. For example, on the one hand, there might have been many students who have increased listening abilities thanks to the researcher's CALL instruction, but who have not shown any increase on their MI quotients. On the other hand, there might be many students who have not increased their listening abilities, but who have shown noticeable increase on their MI quotients thanks to the researcher's CALL instruction. This mismatch indicates that listening skills may not be good skills to correlate with the quotients of MI types in the first place. It is interesting to see what other types of language skills (e.g., reading) would correlate better with the quotients of MI types, if any.

Although the third question does not have a resolution based on the data collected, nonetheless, it appears that CALL instruction contributed to increasing students' MI quotients to some moderate extent. In particular, the score increase in Spatial, Linguistic, and Logical-mathematical types appears to correlate well with the researcher's use of CALL instruction.

DISCUSSION: ISSUES IN APPLYING MI TO CALL INSTRUCTION

The study of learning styles and concomitant teaching practices has blossomed over the last thirty years (Sims & Sims, 1995; Chamot, 2004; Silverman, 2006). In particular, multimedia-assisted teaching and learning has come to the forefront in the English language teaching arena with the advent of modern computers and communication technology (Thornburg, 1997). Thornburg argues that MI pedagogical models provide educators with concrete strategies for addressing the needs of every learner through multimedia programs. He further claims that modern technological tools enable us to work with information in ways that honor the unique learning styles of each student (Thornburg, 1997, p. 2).

Keobke (1998) suggests two ways in which CALL materials can be adapted to different learning styles. The first suggestion is to match appropriate programs to students' learning styles. For example, students studying grammar who tend to favor rule-based learning will benefit most from language learning software like the *Wida programs* (2008), specifically *Choicemaster* and *Gapmaster* (both of which are web program titles offering various multiple choice (see *Choicemaster*) and fill-in-the-blank (see *Gapmaster*) exercises).

More sophisticated language-learning programs—such as *English Discoveries, Triple-play Plus, Tell Me More, ELLIS*—tend to allow students more autonomy and a wider range of activities from which to choose. The second suggestion is to improve language skills through collaborative learning activities that encourage students' explicit engagement. Collaborative and/or interactive activities are fully supported by newer software and Websites. For example, *Tell Me More,* the integrated software used in the CALL course in this study, allows students to interact orally with the characters built into it. Students showed high motivation to learn English when they were engaged in talking to the character on the screen, recording their voice, and replaying it afterwards. They subsequently interacted and collaborated extensively when they worked on a group presentation of their online research.

Based on the data examined, this study has shown that students' MI quotients improved to some extent, depending on the types of intelligences used in instruction. Although one may disagree that CALL instruction will help students improve academically, there is ample reason to claim that CALL instruction will help students learn languages better when MI is implemented. Understanding the premise that learners prefer to utilize different learning styles, and using multimedia materials to expose students to multiple ways of learning languages, will create a language-learning environment that enhances the chances of satisfying learners' individual needs.

CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

The analysis of data in this study reveals that CALL instruction helped students improve their TOEIC listening scores as well as their MI quotients in significant ways. However, the direct correlations between TOEIC listening scores and MI quotients turned out to be low. This result may involve two primary factors: First, the number of subjects who participated in this experiment was small; thus, one must be cautious not to overgeneralize the results. Second, the period of CALL instruction was only one semester, amounting to less than 50 hours. Since human intelligences may change over a long period of time, MI quotients calculated during this limited number of hours may not be permanent, thereby circumscribing the results. If one were able to teach students with CALL instruction for a large number of hours (i.e., over 300), we may be able to obtain a more significant change in students' MI quotients.

From a pedagogical point of view, MI theory offers ESL/EFL teachers a way to examine their teaching techniques and strategies in light of human differences. Since teachers' language-learning materials affect the multiple intelligence profiles of their students, we must identify the activities that we frequently use in our classes and categorize them to see which ones help develop which types of students' intelligences. An understanding of MI theory supports the notion that multimedia technology and CALL have a significant role in the classroom. Since technology and MI provide a winning combination, maximizing the use of technology in language teaching is both encouraged and desired.

In the future, it is likely that multimedia software will be developed specifically to assist students in developing their intelligences while learning languages. MI-based language learning through technology offers a powerful combination that will surely help teachers create better and more flexible, reflective, logical, and creative activities.

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Dr. In-Seok Kim *is professor of ESL and Applied Linguistics in the English Language Department at Dongduk Women's University in Seoul, Korea. He earned his master's degree in TEFL at Southern Illinois University in 1982 followed by a doctoral degree in Applied Linguistics at Teachers College, Columbia University in 1988. He held a year-long postdoctoral research appointment at MIT in 1991 and at Harvard in 1992. He briefly taught at Brown University afterwards. He held a visiting appointment at the University of California at Irvine from 2006 to 2007. From 2004 to 2007, he served as chairman on the Committee of National English Curriculum. His major research interests have been in second language acquisition, multimedia-assisted language learning/teaching, and design and developments of multimedia English content.*

E-mail: iskim@dongduk.ac.kr Webpage: http://www.eflcall.com

Appendix A: MI Questionnaire (English Version)

Instructions: For each item circle the response that best represents your approach.

Strongly Agree **5** Agree **4** Undecided **3** Disagree **2** Strongly Disagree **1** *Example:* 1 I like to hang out with my friends.	**Legend** LIN: Linguistic L-M: Logical-Mathematical SP: Spatial Mus: Musical B-K: Bodily-Kinesthetic Inter: Interpersonal Intra: Intrapersonal Nat: Natural

Section 1

a. I like to read books. (LIN)
b. I try to sort out complex things in a logical way. (L-M)
c. I like to draw a picture or sketch when I think. (SP)
d. I like to sing when I am alone. (Mus)
e. I like to repair or make things for myself. (B-K)
f. I am good at making friends in school. (Inter)
g. I like to spend time on thinking of things that are important to me. (Intra)
h. I like to stay outside home as often as possible. (Nat)

Section 2

a. I try to use words that I learned newly in my talking and writing. (LIN)
b. I prefer to do math social studies or English. (L-M)
c. I know how to tell subtle differences in colors, lines, and shapes. (SP)
d. I often like to listen to music. (Mus)
e. I am good at balancing. (B-K)
f. I enjoy attending meetings or parties at the social clubs. (Inter)
g. I think highly of my independence. (Intra)
h. I make a good prediction on weather changes. (Nat)

Section 3

a. I am good at making points or explaining things. (LIN)
b. I am good at finding patterns or errors in a certain situation. (L-M)
c. I like to visualize certain ideas well. (SP)
d. I often tap rhythmically on the table or deck. (Mus)
e. I learn new dances and sports very easily. (B-K)
f. I make it a rule to go to the party for fun. (Inter)
g. I often talk to myself looking at a mirror. (Intra)
h. I am concerned with environmental problems such as beach pollution, park reservation. (Nat)

Section 4

a. I am good at talking figuratively, using languages full of expressions. (LIN)
b. I work well with numbers and data. (L-M)
c. I can read maps easily. (SP)
d. I play musical instruments well. (Mus)
e. I often talk, making gestures with hands. (B-K)
f. People like to make friendships with me. (Inter)
g. I often think of my self-worth and my responsibility. (Intra)
h. I did biology better than chemistry when I was a high school student. (Nat)

Section 5

a. I make a good use of vocabulary in describing objects. (LIN)
b. I always look for patterns, regularities, and logical connections from my work. (L-M))
c. I visualize the story in my head when I read. (SP)
d. I can tell when music sounds off-key. (Mus)
e. I engage in physical activities even though they are physically demanding. (B-K)
f. I look for opportunities through which I can make new friendships. (Inter)
g. I like to think hard before I take certain actions. (Intra)
h. I like recreational activities such as hunting, fishing, watching birds, etc. (Nat)

Section 6

a. I am good at persuading people to do things. (LIN)
b. I feel comfortable with abstract ideas. (L-M)
c. I concentrate on what I watch more than on what I listen to. (SP)
d. I know many songs as if I had a good library of song titles in my head. (Mus)
e. I am easily bored when I sit quietly. (B-K).
f. I tend to ask other people when I need to make an important decision. (Inter)
g. I like to spend time alone. (Intra)
h. I am good at raising plants and flowers. (Nat)

Section 7

a. I am highly interested in the meanings of words. (LIN)
b. I am able to understand charts and diagrams easily. (L-M)
c. I am good at decorating things with colors. (SP)
d. I like to make up a new melody and sing a song. (Mus)
e. I like to figure out how things operate by manipulating them with my hands. (B-K)
f. I try to avoid conflicting situations and make efforts to get along, when they occur. (Inter)
g. I like to set up a certain goal for myself. (Intra)
h. I like to draw or take a picture of natural objects. (Nat)

Section 8

a. I like to write. (LIN)
b. The topics and discussions on sciences interest me. (L-M)
c. I can visualize the other angle without looking at it. (SP)
d. I am good at tapping out musical beats. (Mus)

e. I am good at hand-crafting such as making wood crafts, making models, and needling. (B-K)
f. I am born to make people around me feel comfortable. (Inter)
g. I tend to rely on my own decision, not paying attention to other people's advice. (Intar)
h. I like to go hiking and camping. (Nat)

Section 9
a. I like to go to the bookstore or library to look for a new idea. (LIN)
b. I believe that there is a logical rule governing phenomena in the world. (L-M)
c. I remember people's face rather than their names. (SP)
d. I know the clear difference between the songs I like and those that I don't like. (Mus)
e. I prefer to engage myself in sports rather than watching them on TV. (B-K)
f. I often help my friends. (Inter)
g. I like to own a small business rather than work at the company. (Intra)
h. I feel more comfortable outside than inside. (Nat)

Section 10
a. I am good at doing crossword puzzles and word games. (LIN)
b. I enjoy doing games that require strategies and skills. (L-M)
c. I am good at finding pictures in a picture dictionary and finding ways in a labyrinth. (SP)
d. I enjoy listening to the top 20 music hits. (Mus)
e. I am good at mimicking the physical actions of other people. (B-K)
f. I like to work well with other people through cooperation. (Inter)
g. I like to play games such as computer games that I can do by myself.(Intra)
h. I am good at finding my way by looking at the sun or stars in the deep forest. (Nat)

Appendix B. The Multimedia Technology-Assisted Course Syllabus

Week	Software Title/Internet Site	Language Learning Activities
1	Course Orientation	general orientation to the course; pre-test
2	WINTOEIC Software (Suh-Il, 2000)	listening (Parts 1, 2, 3, 4), dictation, vocabulary, grammar; pictures of dialogues
3	WINTOEIC Software (Suh-Il, 2000)	listening (Parts 1, 2, 3, 4), dictation, vocabulary, grammar; pictures of dialogues
4	AFKN Software (Suh-Il, 1999)	listening to AFKN news, dictation vocabulary; pictures of news reports
5	AFKN Software (Suh-Il, 1999)	listening to AFKN news, dictation vocabulary; pictures of news reports
6	TELL ME MORE Software (Auralog, 1995)	listening, dialogue practice, grammar, pronunciation practice with automatic speech recognition engine, dictation, vocabulary, pair practice, presentation; video of a long listening passage, pictures of words
7	TELL ME MORE Software (Auralog, 1995)	listening, dialogue practice, grammar, pronunciation practice with ASR engine, dictation, vocabulary, pair practice, presentation of dialogues; video of a long listening passage, pictures of words,
8	Midterm	
9	Connected Speech (Auralog, 2001)	listening, pronunciation practice with ASR engine, dictation; pictures of dialogues
10	Connected Speech (Auralog, 2001)	listening, pronunciation practice with ASR engine, dictation; pictures of dialogues
11	Randall's ESL Cyber LAB (http://www.esl-lab.com)	Multiple Choice Listening, dictation, vocabulary, dialogue presentation, pair practice; video of a listening passage
12	Randall's ESL Cyber LAB (http://www.esl-lab.com)	M/C listening, dictation, vocabulary, dialogue presentation, pair practice; video of a listening passage
13	EFLCALL Academy Site (http://www.eflcall.com)	culture listening, dictation, vocabulary dialogue presentation, pair practice
14	Eviews Site (Interview) (http://www.eviews.net)	listening comprehension, vocabulary, dictation, goal setting, presentation of students' life goal
15	Eviews Site (Interview) (http://www.eview.com)	listening comprehension, vocabulary, dictation, goal setting, presentation of students' life goal
16	Final Exam	