



Use of 3D Computer Graphic Contents: Content-based Language Instruction in Japan

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Abstract

The teaching of multi-modal literacy in the classroom environment is a field of emerging interest in education (Jewitt & Kress, 2003; Kress, 2003). Incorporating multimodality in second/foreign language teaching to meet the expectations of the new media age is becoming an important issue. In this study, we designed a textbook for foreign language learners of higher education in Japan. We have used the textbook with a class of twenty-two intermediate to high intermediate level English as a foreign language students. The theme of the textbook is Frank Lloyd Wright who designed the Imperial Hotel in Japan. This article shows the 3D models of the Imperial Hotel, used as a resource in the textbook, discusses the creation of the book, and presents how we have utilized the 3D models as part of content-based instruction for English education in a Japanese university. A survey showed that the 3D models is perceived by students to help them in learning content knowledge of English through context-embedded academic activities.

1 Introduction

We see different *modes* of communication used simultaneously in many contexts today. For instance, if we read a newspaper article on the Internet, chances are, we will find a written article on a particular subject with a color photograph next to it, and additional video footage of the news being covered, all on a same page. If we go to a museum, we can easily rent an audio tour that explains the works of the artists. There may also be a documentary video of an artist playing simultaneously at the exhibition. In this sense, we are increasingly living in a multimodal environment. There is a great need to understand how multimodality can be integrated into different types of educational settings (Jewitt & Kress, 2003; Kress, 2003). How to teach multimodal literacy in the classroom environment is an important issue in education.

Mode is referred to as any semiotic resource that carries meaning (Halliday & Hassan, 1989). Halliday & Hassan (1989) point out that language use is always comprised of *field*, *tenor* and *mode*. In short, *field* is the social context within which language is used, *tenor* is the register or style in which the message is conveyed, and *mode* is the form of representation. *Mode*, defined broadly, is a form of representations that are an “organized set of resources for meaning-making, including image, gaze, gesture, movement, music, speech and sound effect.” (Jewitt & Kress, 2003, p. 1).

According to Jewitt & Kress (2003), the more a certain type of *mode* is used in a culture, the more it displays regularities, similar to how grammar possesses regularity.

This raises an interesting question about knowledge and learning. Just as there are new combinations and forms of communication using multimodality, there may also be *mode*-specific knowledge and learning styles that educators are still not fully aware of. While using multimedia in education can have a number of benefits, educators need to be increasingly aware that there is a possibility that learning occurs differently according to the type of *modes* being utilized in communication.

In considering how to effectively use technology for language teaching, how to utilize varieties of *modes* in classroom environment should be raised. Today, language teachers in Japan are active in integrating existing methods of instruction into their classrooms. However, while a number of projects involving pedagogical approaches such as content-based instruction (CBI) exists, the area of computer assisted language learning (CALL) still needs much research. For instance, there are few studies on actual classroom use of media technologies and pedagogical factors that influence that use (Zapata, 2004; Chapple & Curtis, 2000). In the content-based classroom environment, for example, how to use different multimedia tools to teach content is an issue that needs further research. This article provides a case study of how technology can be integrated into CBI in the English as a foreign language (EFL) classroom, and how pedagogy, in this case CBI, may influence the use of technology in the classroom.

2 Background information

There are many approaches to teaching foreign languages in higher education. For example, among the many teaching approaches are the English for specific purposes (ESP), the skill-based instruction and the CBI approaches. The ESP curriculum is based on a socio-cultural concept known as activity theory (Engstrom, 1993) which stems from Vygotsky's idea of mediated action in constructivist psychology (Vygotsky, 1986). Activity theory captures learning as a dialog among participants in a "community of practice." Activity theory emphasizes the use of language as a cultural artifact which acts as a medium between social contexts, participants in a community, and knowledge learned.

In an ESP curriculum, social context is an important component to be considered. The ESP approach focuses on teaching English that can be used in specifically defined contexts. The main objective of the ESP class is to enable students to utilize English in social contexts found in real world situations. Linguistic knowledge is presented along with specialized knowledge such as professional vocabulary found in a specific discourse community such as in the medical field. Thus, this approach enables one to acquire English use in specific social contexts as well as language proficiency. This teaching method tends to focus more on teaching language components that pertain to socially defined settings usually thought to be found in the real world situations.

In Japan, ESP approach is often used to teach technical aspects of English language such as professional and academic writing to students majoring in specialized fields. For example, in one study, an ESP curriculum was used to support Japanese software engineers with their English writing needs (Narita, Kurokawa, Utsuro & Orr, 2003). Similarly, an ESP approach can be found in university technical writing classes for computer science students (Freiermuth, 2002). An ESP approach is also used in Japanese companies such as Toshiba Corporation's language training program to teach Business English (Morrow, 1995).

In contrast to the ESP approach, CBI in EFL language teaching provides English language development through content area instruction. Wesche and Skehan (2002) define CBI as "integration of school or academic content with language teaching objectives" (p. 220). CBI in language teaching is an approach for Limited English Proficiency (LEP) students that combines the development of language proficiency with content area knowledge. The goal of the curriculum is to prepare students to learn a content area in the target language, while developing English proficiency. For example, the Cognitive Academic Language Learning Approach (CALLA) is a model of CBI pro-

posed by Chamot & O'Malley (1994) which prepares LEP students in the US to participate in mainstream content instruction. The model was originally designed for students who have developed social communicative skills in English and students who are bilingual but still need to acquire academic skill in English. The CALLA model is also recommended for intermediate level English as a second language (ESL) classes.

The CBI approach has three major components: 1) Inclusion of content knowledge; 2) English language development; and 3) Learning strategies (Chamot, 1985, Chamot & O'Malley, 1992; Richard-Amato & Snow, 1992). This approach also integrates language development activities according to Cummins's (1982) notion of *procedural* and *declarative* knowledge (Chamot & O'Malley, 1992). *Procedural knowledge* is defined as the ability to understand and generate language. Examples of procedural knowledge are communicative competence, functional proficiency and fluency. Procedural knowledge is rule-based productive knowledge that allows one to generate language. *Declarative knowledge* underlies factual information that can be acquired quickly such as vocabulary, grammar rules and pronunciation. The language activities in CALLA classrooms are based on the classification of language and content activities within Cummins's (1982) framework (Chamot & O'Malley, 1992). This framework classifies language activities into four dimensions, context-embedded, context-reduced, non-academic activities and academically demanding activities. For example, integrative language skills such as reading and listening comprehension, speaking or writing about academic topics can be classified as academically more demanding activities. Developing survival language skills, according to this framework, can be classified as non-academic activities.

Wesche and Skehan (2002) mention that today there are diverse forms of CBI curricula. Some are strong and some are weak forms of CBI. For example, a strong form of CBI places its goal and emphasis on subject mastery. On the other hand, a weak form of CBI focuses more on developing communicative proficiency in second language through a curriculum organized around the learning of content. Although there are numerous variations of CBI in English learning classrooms, Wesche and Skehan (2002) contend that in successful CBI, learners master both language and content through a "reciprocal process as they understand and convey varied concepts through their second language" (p. 220).

Wesche and Skehan (2002) also stated that, in the last three decades, much research on CBI reported on various initiatives involving programs using the CBI approach. Much of the research findings based on descriptions and evaluations of the actual programs were highly consistent. According to Wesche and Skehan (2002), past research shows that CBI, in general, led to more successful subject content learning and second language learning, as well as a positive attitude change in both instructors and students, compared to that achieved otherwise in academic programs. In addition, it is highly appreciated by students.

For example, Papai (2000) conducted a four month participant observation study at a successful pull-out English to Speakers of Other Languages (ESOL) classroom in a middle school in the US that uses CBI. In this study, CBI was used to teach English as well as different aspects of literacy. For instance, the teacher utilized thematic units, technology and standardized test preparation to facilitate socialization and academic competencies in the US. The curriculum developed literacy abilities that extend beyond reading and writing to include a wide array of academic competencies. This was shown in the improvement of participating students' grades outside of the ESOL classroom. This study demonstrates a systematic effort to promote the academic success of ESOL students.

Butler (2005) also shows that there is a growing interest in CBI in foreign language education, particularly in EFL in East Asia. Butler (2005), through numerous observations of various CBI classes in EFL contexts in East Asia, shows that careful consideration and preparation to meet the particular contexts is needed for successful implementation of CBI in the EFL classroom, which includes setting, characteristics of teachers, attitudes of learners and availability of resources. According to Garner and Borg (2005), although a theoretical basis for the success of CBI has not been fully articulated, overall, CBI has been proposed as an effective approach for preparing stu-

dents for study in English language medium universities, and has won adherents for its pedagogical effectiveness.

Both ESP and CBI are approaches of instruction that integrate content knowledge learning and English development in language classrooms, but to different extents and with different emphases. The two therefore, do not compete with one another, but rather, complement each other.

3 Project

At Keio University, both ESP courses and CBI are offered. CBI is used to raise the motivation of the students and to provide them with opportunities to use English as a tool for learning academic subjects. At this particular university, CBI is integrated into the English curriculum and recommended as a preparation course for students who would be pursuing academic work in English language medium environments. Most of the students, by the time they enter Keio University, possess an intermediate level of English proficiency. For this reason and because CBI can be designed to improve students' academic skills, this approach is considered appropriate at Keio university.

In this research, we first created a textbook for CBI for English learners. Then, we picked a very new *mode* of communication, 3D computer graphics, to supplement the content knowledge provided in the textbook. The 3D models were included on a CD-ROM to be distributed along with the textbook. They were used in CBI classes as visual aids to teach the content knowledge. The teacher used the 3D models for language activities that allowed students to present and to explain the subject in English.

These multimodal materials were pilot-tested for one semester with a group of twenty-two students in an intermediate EFL class at Keio University. One semester comprises thirteen weeks. The class meets for one session per week, and each session is 90 minutes. After the semester was over, we distributed a questionnaire to the students to evaluate the effectiveness of using the 3D materials in a content-based language classroom.

3.1 *Content-based textbook for English learners*

Iinuma (2006) has written a textbook called *Frank Lloyd Wright and the Imperial Hotel*¹, targeting intermediate level English language learners. This topic was chosen as a textbook for EFL learners for a number of reasons. First, the topic encompasses a wide range of disciplines, such as architecture, art, history and intercultural issues. Second, these subject areas are of interest to many of the students majoring in our university department. Frank Lloyd Wright is not only one of the greatest architects of all time, but he is also unquestionably one of the best-known public figures both in the US and Japan. This provides an opening for the Japanese EFL students to culture in the US. While major works of Wright, designed in the later period of his life such as the Guggenheim Museum in New York City and Fallingwater, are well known, his relationship with Japan which began in an earlier period of his life, often referred as "his lost years," remains less well known. He is also well known as an avid collector of Japanese *Ukiyoe* prints and he is known to have possessed a deep understanding of Japanese aesthetics and art. Researchers agree that in designing the Imperial Hotel, Wright was influenced by Japanese art (Meech, 2000; Nute, 2001; Tanigawa, 1995). This makes it a topic that meets the interests of the students studying at Keio university. By using the textbook, students will be able to relate to new ideas, values and ways of thinking by referring back and forth to art and culture. Also, in order to meet the educational purposes of the university, the topic was chosen through consultation with other members of the university. The content of the textbook was reviewed by Masami Tanigawa who is an expert in the area of architecture, especially on works of Frank Lloyd Wright in Japan.

The textbook is organized into four parts and ten chapters. It was written to accommodate the Japanese university semester and is organized to be covered in ten to thirteen weeks. The ten chapters describe the story behind Frank Lloyd Wright and his relationship with Japan. The first

part describes who Frank Lloyd Wright was. The second part moves on to how Wright encountered Japan. The third part is about the Imperial Hotel and Wright. In the last part, the textbook describes Wright's legacy and his other works in Japan. The textbook consists of 98 pages. Student activities, discussion topics, group activity ideas, vocabulary lists and questions based on each chapter's reading are also included in the textbook.

3.2 3D computer graphics for content-based textbook

3D computer graphic models of the Imperial Hotel designed by Frank Lloyd Wright were also created as supplementary resources that accompany the textbook. The Imperial Hotel, built in 1923 in Tokyo, Japan, and demolished in 1968, is considered as one of Frank Lloyd Wright's masterpieces designed from his early years. Frank Lloyd Wright first visited Japan in 1905. After securing a commission to design the Imperial Hotel, he visited Japan five times from 1917 to 1922. The Imperial Hotel was a work of art that united Western and Eastern art. Today, a part of the hotel remains and has been reconstructed at an outdoor museum in Aichi Prefecture.

Our project team² used advanced 3D technology to recreate the Imperial Hotel. We began creating the 3D models by collecting photographs and documents of the demolished Imperial Hotel. Before the Imperial Hotel designed by Wright was demolished in 1968, a group of researchers from Waseda University in Japan photographed and measured the architectural structure of the building³. We referred to their study in creating the 3D models. We also referred to photographs owned by the Imperial Hotel in Tokyo. The Frank Lloyd Wright Foundation also owns original drawings and historical photographs which document Wright's work, to which we also referred.

The purpose of creating the 3D models was twofold: one was to recreate the lost building using 3D technology by collecting documents, photographs and historical data to document the lost building; and another was to use the 3D models in a CBI classroom for educational purposes. It was assumed that students are able to learn content knowledge such as artistic, architectural, and historical aspects of the Imperial Hotel better using the 3D models.



Figure 1: The Imperial Hotel 3D model

Figure 1 shows an example of a 3D model that was created based on such data. The model shows the structure of the whole building and can be manipulated on a personal computer screen. Figure 2 is another example of a recreated 3D model. This is a 3D model of a promenade, a

walkway to a banquet hall which was used to hold social events and parties at the Imperial Hotel. These models were created so that the students in the English class can refer to them when the instructor was explaining the characteristic aspects of the Imperial Hotel, such as its interior decoration, different types of public spaces available in the hotel, and the materials used for the building. The students taking the class also referred to the models when they were reading the English text, discussing with other members of the class in English and also when they were speaking in English about the Imperial Hotel.



Figure 2: 3D model of the promenade



Figure 3: The lobby of the Imperial Hotel

Figure 3 is an example of another 3D model, which shows the lobby of the Imperial Hotel. The lobby was rebuilt at Meiji Mura Museum in Aichi prefecture, Japan. However, the other parts of the hotel were demolished and no longer exist today. A total of six 3D models such as the examples shown above were created and made available on a CD-ROM.

3.3 Creation of a companion website

In addition to the 3D models and the textbook, we also created a group share website that showed works of art, posters and brochures used at the Imperial Hotel in the 1920s as well as historical photographs of the hotel. In the classroom, the students used the group share website to upload their homework and to participate in activities such as online discussions. We also video-recorded the lectures of the instructor, classroom discussions and student presentations. These digital contents were uploaded onto the shared website so that they became available online for the students. Figure 4 is a picture of the group share website that was used in the classroom.

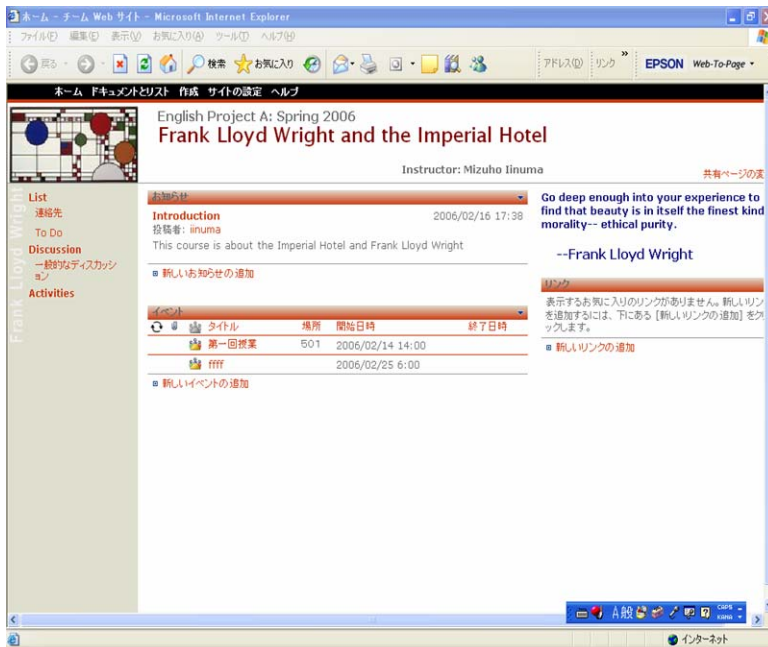


Figure 4: Group share website for the class

3.4 Classroom case study

Each class meeting consisted of the following phases: 1) motivational questions; 2) reading sessions; 3) individual exercises; 4) group exercises; and 5) conclusion. In the first section of the class, the instructor started the classroom with a motivational question or an exercise. For example, an image of *Ukiyoe* was shown to the class, and the students were asked to react to what they saw. In the next section, the instructor gave a fifteen to twenty minute lecture based on the textbook. The students were asked to participate in class by responding orally to the instructor's questions or by reading the text passage. Each lecture was video-recorded and uploaded onto the class website after each session (see Fig. 4). In the third section, the students individually reviewed the reading materials and answered the reading interpretation questions. Declarative knowledge such as grammar and vocabulary points were introduced at this point in class. In the fourth section, the students discussed each chapter of the book with their partners. Finally, in the last section of the class period, students participated in group activities and presented their work to the class in English, which allows the students to practice their procedural knowledge of English in different modes of communication. For example, in the group activities in the last section of the class period, students used the 3D models that came with the textbook and used them for discussion and presentation. Figure 5 shows an example of a group activity and presentation by the students using

a 3D model. The students were asked to manipulate the 3D models on a computer screen and to describe what they were showing in English. The advantage of using the 3D models in the CBI is that they not only supplement, but also visually enhance the content covered in class. Unlike other media such as video or film, another advantage of utilizing 3D models is that they allow the students to actively engage and to interact with the models, thus allowing them to virtually experience being 'inside' a building. The students experience being in a virtual social context and are asked to act and to speak as if they were visiting an 'authentic' place.

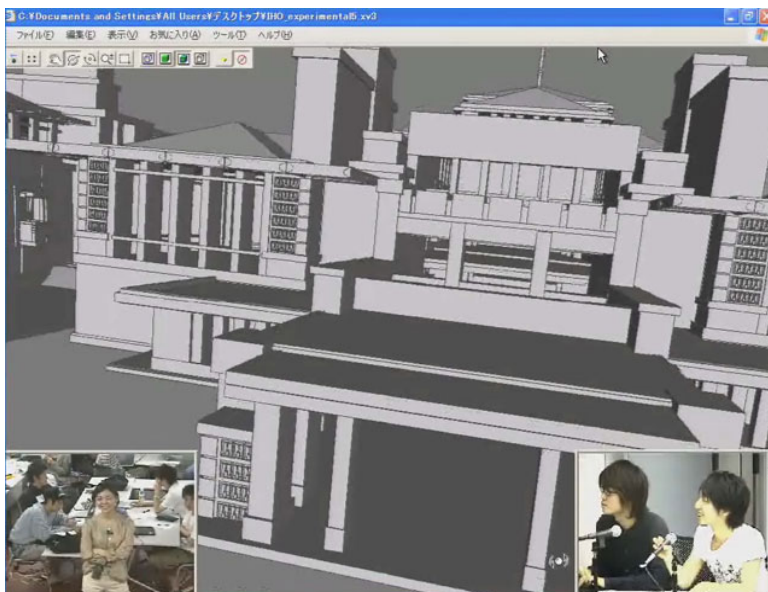


Figure 5: Student presentation using a 3D model

Table 1 describes an example of the kind of interaction which occurred when the students used the 3D models in an English development activity. It shows an example of the interaction between students, teacher, and the 3D model. In this activity, the students were asked to use the 3D model of the Imperial Hotel to explain what he/she thought was characteristic of the hotel. The 3D model was used as a medium for explanation. The students were asked to manipulate the 3D model which was projected upon a large screen on the wall. Using a mouse, the student could move the 3D model to make it appear larger or smaller. They could also move the model in four different directions using the computer mouse. The students could also move forward and backward as if he/she is walking into the 3D model.

Time Screen	Person	Speech	Gesture	Gesture on
31:22	Student	This is Imperial Hotel		3D model is shown on the screen
	S	Maybe this is entrance		zooms in to make the 3D model look larger
	S	Maybe there are		
	S	This is lake		points with the cursor
	S	And		
	Teacher	No that is not a lake, it is a pond		
	S		Nods	
	S	Many interesting objects		zooms in to make the 3D model look larger
	S	For example this one		points to a pillar using the cursor
	S	And this one		points to a sculpture using the cursor
	S	Guests stay maybe--		
			Moves the 3D model to show the second floor of the building	
32:49	S	there... OK		

Table 1: Student interactions using the 3D model

The transcript of the student interactions using the 3D model shows that using the 3D model is quite unlike interacting with other media. One can handle a 3D model like how one handles an object. However, unlike a regular object, one can transform the way in which the object is presented by changing the angle, size and perspective. For example, the student in the transcript handled the 3D model like an object, but he emphasized what he thought was important in his/her speech by enlarging the object. This type of object manipulation and explanation is peculiar to using three-dimensional objects. Unlike a two-dimensional mode of expression, such as a picture, the student can transform the object being talked about, by making it look larger or smaller, synchronously, as he/she is talking. This type of interaction with an object can be done without any preparation. This is one aspect of using 3D computer graphics which differs from using, for example, a film in the classroom.

4 Evaluation of project

After thirteen weeks of class work, a questionnaire was administered to the twenty-two students who took the class. The purpose of the questionnaire was to evaluate the project from the perspective of the learners. The evaluation was meant to establish students' perceptions of the quality and usefulness of the course. The questionnaire was also used to collect data on the students' perceptions of the use of 3D models in CBI. There were a total of twenty-nine questions in the questionnaire. Twenty-four questions were in a five-point Likert-type survey format, ranging from [1] "did not enjoy at all" to [5] "enjoyed very much." Four questions were free writing questions which asked the students to explain their answers in sentences. One question was a multiple-choice question in which the students were asked to choose from a choice of answers. The questionnaire consisted of three topics: class satisfaction, types of knowledge learned, and the effectiveness of the use of 3D models (see Appendix 1 for a sample of the questionnaire).

5 Results

Figures 6 to 11 as well as Table 2 show the results of the analysis of the questionnaire data.

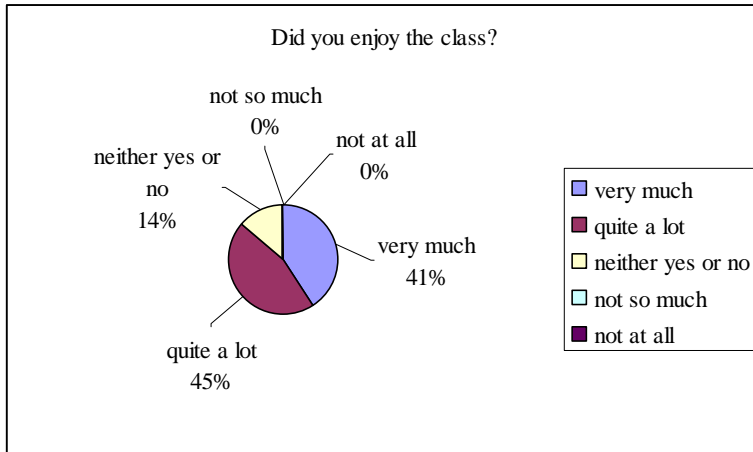


Figure 6: Question on student satisfaction

The first section of the questionnaire asked whether the students enjoyed the class. Out of five Likert-type answers from [1] “did not enjoy at all” to [5] “enjoyed very much,” we received [3], [4] or [5] for all the answers. As the result, 86% of the twenty-two students rated their satisfaction as above average. In the next section of the questionnaire, 95% of the student answered “very much” or “quite a lot” to the question “Did you gain new knowledge in this class?” Figure 7 presents the detailed percentages.

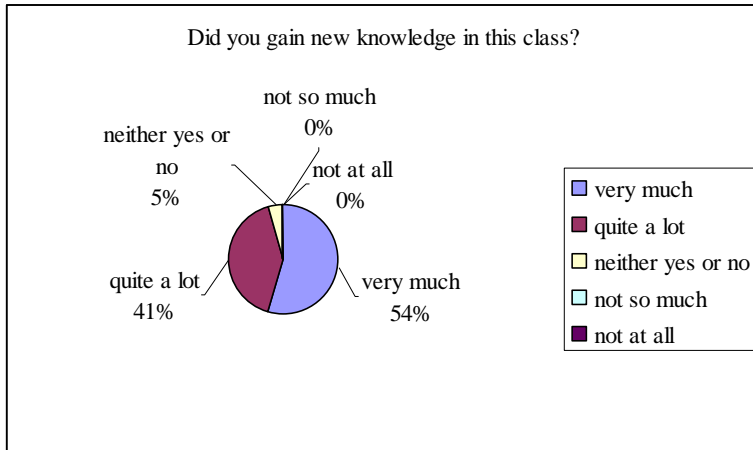


Figure 7: Question on knowledge learned in class

In the questionnaire, we asked those students who answered [5] “very much” and [4] “quite a lot” to the question “Did you gain new knowledge in this class?” to explain their answer in a free writing format. Their answers were counted according to the topics raised by the students. For example, if a student answered, “I learned about Frank Lloyd Wright’s architectural design and new English expressions,” we counted the first half of the answer, “Frank Lloyd Wright’s architectural design,” as knowledge about Frank Lloyd Wright, and the later half, “new English expressions,” as English knowledge. The comments that were mentioned by the students in the free writing section were classified into five different categories: knowledge about Frank Lloyd Wright; knowledge about Japanese art; cross-cultural issues; English language skills; and others. The result

is summarized in Figure 8. The result shows that more students felt they learned content knowledge, as opposed to English skills in this class.

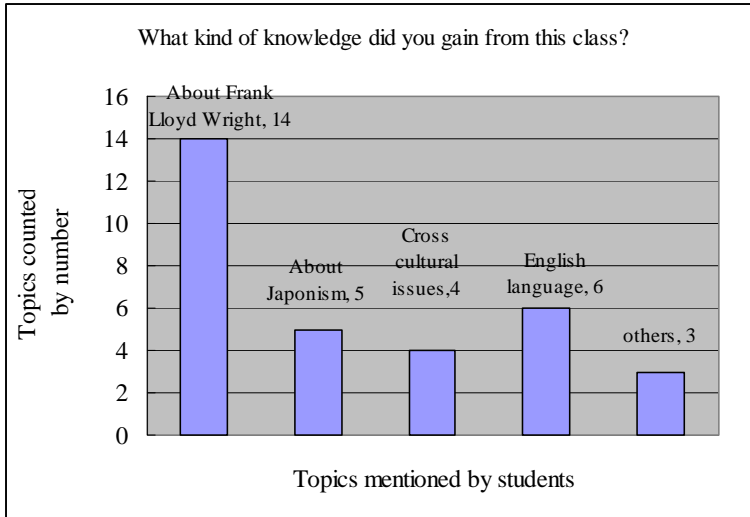


Figure 8: Free writing answers about the types of knowledge students gained

The third section of the questionnaire asked the students about the use of 3D models. The result shows that 68% of the students said they either liked using the 3D models in the classroom environment, or they liked them very much. 27% of the students held neutral views about the usage, and 5% of the students did not like using 3D models so much. Figure 9 presents detailed percentages.

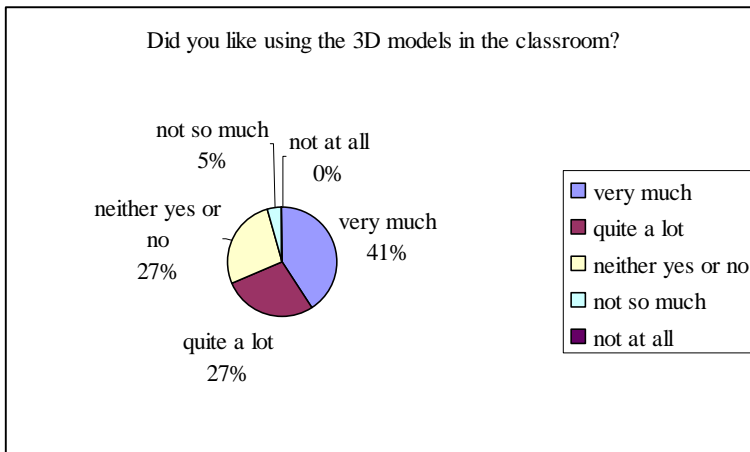


Figure 9: Question on the use of 3D models

Although 27% of the students said they had a neutral feeling about the use of 3D models in classroom environment, only 9% of the students held neutral views about the effectiveness of using 3D models in understanding the structure of the building, in this case, the Imperial Hotel designed by Frank Lloyd Wright. In the questionnaire, 36% chose “quite a lot” and 55% answered

“very much” when asked whether they thought the use of 3D models helped them in understanding the structure of the building. The result is shown in Figure 10.

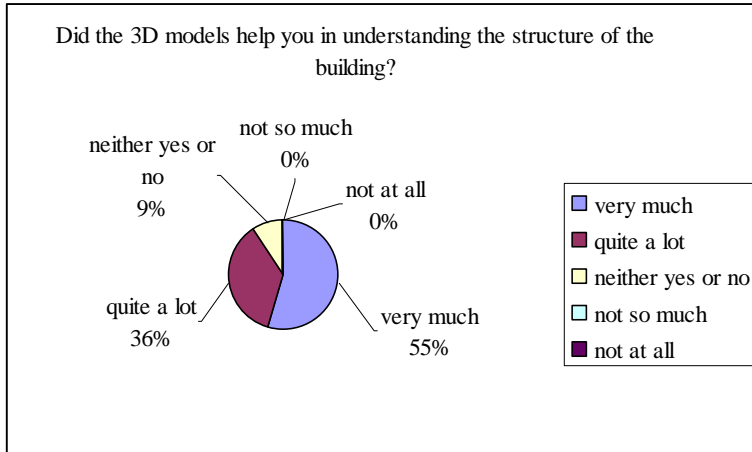


Figure 10: Question on whether the 3D model helped in understanding the structure of the building

In comparison to the number of students who answered positively to the question of whether the 3D models were helpful in understanding the structure of the building, less students felt that they were useful in understanding the English text. Nevertheless, 77% of the students answered favorably and said that the 3D models helped them in understanding the content of the English text used in the classroom. Figure 11 presents the result.

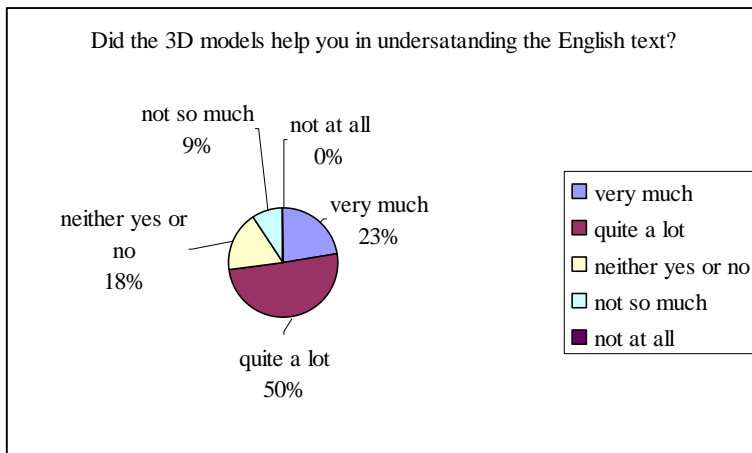


Figure 11: Question on whether the 3D models helped in understanding the English text

In the next section, the students were asked, “What do you think is the learning effect of using the 3D models?” For this question, twenty-two students answered the question. The students could choose from multiple choices of answers and were given the freedom to choose more than one answer. All twenty-two students chose “understanding of the structure of the building” as their choice of answer. In addition to the first choice, thirteen students chose “helped me in understanding what the teacher was saying.” The result shows that the students felt 3D models were helpful in learning about the structure of architecture, and that they acted as a visual scaffolding in under-

standing the instructor's speech. In addition, six students thought 3D models were helpful in giving English presentations. Only one student said it raised his/her motivation to learn about the topic. Table 2 presents the detailed results. These answers indicate that 3D models can be integrated well into English development activities that focus on procedural knowledge of the language.

Choices of answers	Number of students who picked the answers
Understanding of the structure of the building	22
Motivation to learn more about the topic of the class	1
Understanding what the teacher was saying in English	13
Helped me when I presented in English	6
Others	1

Table 2: Multiple-choice question on “What do you think is the learning effect of using the 3D models?”

Many of the students thought that the 3D models were helpful in understanding the structure of the building. Many students also thought that the 3D models helped them in understanding what the instructor was saying in English. Few students said that 3D models were helpful in making English presentation, or that it raised their motivation in learning about the topic. The questionnaire showed that the advantage of using 3D models in an English language classroom is in providing students with a tool for understanding complex content material that can be expressed in three-dimensional format.

Wesche and Skehan (2002) report that students tend to appreciate the CBI curriculum. Consistent with prior research, the findings of the questionnaire showed that CBI course was enjoyed by most of the students who took this class. Almost all the students felt that they learned new content knowledge by taking this course. The questionnaire also showed that the students felt they learned content knowledge more than procedural knowledge of English. Since the goal of the curriculum was for the students to learn about academic content in English, this course can be characterized as the strong of CBI approach form (Weshe & Skehan, 2002).

In addition to the overall enjoyment of the course, the use of 3D models was also enjoyed by the students. The students felt that the 3D models helped them in understanding the complex structure of architecture. In this curriculum, explanation of architectural design is written in the textbook. However, the students used 3D models to comprehend the meaning of the text. The questionnaire also showed that the 3D models helped the students in understanding what the teacher was saying in English as well as the English text used in class. For example, the teacher often gave lectures on the structural aspects of the architecture in English while showing the 3D models to the students. It seems that the 3D models helped the students in understanding the English lectures given by the teachers in such contexts. This finding may imply that 3D acted as visual information in understanding academic content presented in English, which may have led to greater enjoyment of the course.

6 Limitation of the study

In this study, we were only able to offer the course to twenty-two students. Therefore, the sample size may be too small to make any claims to conclusive findings. Furthermore, we collected mostly quantitative data from the questionnaire. The evaluation is based mainly on the analysis of the questionnaire data. Qualitative data such as interviews and more detailed descriptions of classroom activities could have been added. In addition, the study needs to be continued with different sets of students to lay claim to a stronger finding. However, the 3D models seem to have acted as scaffoldings to support the understanding of the students' weaker language, in this case English, by providing them with visual aid to the academic content presented in the class.

7 Conclusion

In this study, we considered that the different uses of *modes* of communication, such as text, audio and video in the classroom environment, form an important topic that language educators should consider in teaching. At Keio University, we have two different pedagogical approaches to English teaching. One is ESP and the other is CBI. In the content-based classroom environment, for example, how to use different multimedia tools to teach content is an issue for further study. This article provides a case study of how technology can be integrated into CBI, and how the pedagogical approach may influence the use of technology in the classroom.

At the beginning of the project, we created a textbook for CBI for English learners. We then created 3D computer graphic models of the Imperial Hotel designed by Frank Lloyd Wright to supplement the academic content provided in the textbook. We also implemented and used the textbook and the 3D models in the CBI curriculum, and pilot-tested the materials for one semester with a group of twenty-two students in an intermediate EFL class. We also evaluated the communicative practices of the students interacting with the 3D models using observation techniques and questionnaires.

Our result is congruent with prior research on CBI instruction in that the overall satisfaction of the students taking the CBI curriculum tends to be very high. While the much of prior research does not focus on the use of new technologies in CBI instruction, our research shows that new media, such as 3D computer graphics, can be integrated into CBI instruction and can achieve a very high level of satisfaction among the students taking the course. Our research also shows that, by integrating 3D models as a visual supplement to support the academic content of the course, it can help the students better understand the academic content provided in English. From our questionnaire, it seems that, overall, the 3D models were welcome additions to the classroom environment for the students. Students were interested in working with the models, and enjoyed using them.

While multimedia educational content consists frequently of videos and audio materials, we believe that 3D models can also be included as a learning tool for learners. We also think that one advantage of having 3D contents in classrooms is that they can be used interactively by students. For example, in one classroom activity, students moved the 3D model on a computer screen and explained it in English. Having 3D contents also add variety to the aids which teachers can use in the classroom. 3D computer graphics can be integrated into CBI to help ESL learners move away from a non-academic activities to activities for learning academic content.

This brings us back to the question of how to integrate multimodality in educational settings. Educators need to understand that different types of media are suitable for different purposes. 3D models, for example, as a “mode” is probably more suitable for showing spatial relationship than films. 3D technology is unique in its interactive features compared to films. In this sense, the media technology itself may amplify or emphasize certain ways of seeing. In the future, we would like to investigate more by collecting qualitative data on learning that occur in class using 3D technology. In addition, different research designs such as discourse analysis and interviews may be useful tools to analyze student interactions and learning in a language classroom.

Notes

¹ Inuma (2006) was published as part of this project by Keio University’s Research Institute for Digital Media and Content as an internal publication.

² The project team consisted of graduate students at Keio University studying media arts and 3D computer graphics as well as faculty members. It was funded by the Research Institute for Digital Media and Content (DMC), Keio University.

³ The research by Waseda University led by Akashi was originally published in 1968. In 2004, a shortened version was published (Akashi, 2004). We used both versions to create the 3D models.

Acknowledgement

This project was funded by the Research Institute for Digital Media and Content (DMC), Keio University. In addition, we were also supported by many people including staff and researchers. We especially thank the Imperial Hotel in Tokyo, Japan. We would like to thank the graduate students at Keio University, especially Tomoki Itamiya, M.A., Tomoyuki Hibino, Daisuke Kato, Takuto Negishi and Aya Uchida for their assistance. We also thank Risa Yano for helping us collect data for this study.

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Appendix: Sample Questionnaire

1 Did you enjoy class?

Very much 5	Quite a lot 4	Neither yes or no 3	Not so much 2	Not at all 1
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2 Did you understand the instructor's English?

5	4	3	2	1
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3 Was the content of the course easy to understand?

5	4	3	2	1
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12 Did you gain new knowledge in this class?

5	4	3	2	1
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13 For those of you who answered 5 or 4 to question no.12, please explain what kind of knowledge you gained in this class.

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16 Did you like using the 3D models in the classroom?

5	4	3	2	1
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17 Were the 3D models useful in understanding the structure of the Imperial Hotel?

5	4	3	2	1
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18 Did you like interacting with the 3D models?

5	4	3	2	1
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19 Were the 3D models useful in understanding English?

5	4	3	2	1
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20 What kind of learning effect did the 3D models have? Please write a check next to the answer you feel is suitable. You may select more than one answer.

Understanding the structure of the architectures	
Motivation to learn more about the topic of the class	
Understanding what the teacher was saying in English	
Helped me when I presented in English	
Others ()	