INTERNATIONAL GRADUATE STUDENTS
OF SCIENCE IN JAPAN:
AN ETHNOGRAPHIC APPROACH
FROM A SITUATED LEARNING THEORY PERSPECTIVE

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To all the international students
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ABSTRACT

With situated learning theory employed as a theoretical framework, the purpose of this dissertation is to clarify learners' needs by focusing on practices of international graduate students (IGSs) in a science lab in Japan, rather than confining the study to their language needs. For that purpose, I shed light on how IGSs participate or are not able to participate in the lab community of practice (CoP) in detailed and concrete manner.

IGSs' ways of participating in a community are examined by focusing on the following points. First, I illustrate how access to lab practices is socially organized, by analyzing how two IGSs were able to access machines or not. Further, I also show how their trajectories of participation (crossing or moving among various formal and informal activities) were different and how these differences facilitated or restricted their access to scientific resources. Second, inspired by recent theorization of Dreier and Lave from a situated learning perspective, I illustrate participation as the crossing of multiple CoPs. In doing so, I argue for trajectories of participation as unique and multiple ways of participation, rather than participation as a linear process from newcomer to oldtimer or from peripheral to full participation in a CoP. Identity formation is also reformulated as discovering and constituting one's unique self through crossing multiple CoPs, rather than merely as becoming a member in a CoP. Further, I show that identity formation may be regarded not merely as adjusting the relationship among multiple communities within individuals, but as the practice of organizing new linkages among communities and of
reconstituting CoPs.

The above points showed how to design a learning environment which will address IGSs' needs. For example, how to arrange participation in multi-layered activities and various mutually constituted occasions for IGSs is critical for responding to IGSs' broader needs such as accomplishing research. In brief, design of learning environment for addressing needs can be formulated as designing resources, social organizations, and opportunities that support the members' participation in a CoP and thus their access to the CoP's practice.
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CHAPTER 1
INTRODUCTION

Becoming a “member as those” is an embodied telos too complex to be discussed in the narrower and simpler language of goals, tasks, and knowledge acquisition. There may be no language for participants with which to discuss it at all – but identities of mastery, in all their complications, are there to be assumed (in both senses.)

(Lave & Wenger, 1991, p. 85)

1.1 Rethinking needs

The purpose of this dissertation is to re-conceptualize second language learner needs by focusing on practices rather than on language. By the term “practices”, I mean a set of collaborative and social activities1 producing something or orienting toward some place in everyday life. Focusing on practices means focusing on ways of everyday life. In other words, focusing on practices is focusing on social activities which constitute everyday life. In short, I will argue to reconsider second language learners’ needs as their needs in their everyday life, including work, and research life. From this point of view,

1 In this dissertation, I use the term “an activity” or “activities” in an ordinary sense, not as a special term used by activity theorists (Engeström, 1987 & Leonti’ev, 1978).

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language needs can be reformulated not as something confined within a language system but as something related to practices. The particular practices that I will be focusing on are those of a graduate school science lab in a university in Japan, and I will be trying to identify the needs of international graduate students (henceforth IGSs) in terms of these practices.

In previous needs analysis/assessment (hereafter NA) studies in SLA, needs have been perceived solely in terms of linguistic needs (Long, 2000; Brown, 1995; Unedaya, 2003; Yoneda & Hayashi, 2003; Komiya, 2001, 1995; Fukao & Baba, 2000, for example). Moreover, language has been treated as a closed set of inventories or as a resource in and of itself. There are at least three aspects of needs which had not been addressed in this approach to NA. These three aspects have not been addressed but feasibly could be addressed by the approach I described above. However, the following, thus we could benefit from a new different approach. First, to date, NA in SLAs has not considered needs in practices. In the case of IGSs, needs analysts have been paying attention to language classrooms and science classrooms, but not their graduate student life including
classes. Second, relating to the first point, since language has been perceived as closed system, it has never been perceived as a vital constituting part of practices. Language use has not been considered as part of social activities for organizing everyday life, work or research. Thus language needs have been perceived in a quite restricted way. Third, needs have been treated as something which can be translated into discrete and static entity. In sum, previous approaches do not have the perspective to view practice in the theoretical framework, they have been trying to determine needs for IGSs without seeing their practice.

In reality, second language learner needs are not limited to needs which can be fully expressed in linguistic terms. Rather, learners’ needs are tied to their everyday practices. For example, in the lab I studied, one of the problems commonly encountered by the IGSs was that they could not easily gain access to the lab’s shared equipment and other resources such as the knowledge of how to use the equipment. Through my observations, I found that it was necessary for IGSs to construct social relationships with other lab members, and to pursue opportunities for interaction with these colleagues, in
order to establish a position in the lab that would enable them to gain access to the equipment or to obtain knowledge about the equipment. However, this is not easy work for IGSs.

In an experimental science lab, without being able to access machines and knowledge for utilizing machines, one cannot conduct an experiment, nor can one write an academic paper. For the IGSs in my study, the biggest problem seemed to be that they could not accomplish their primary work for having failed to construct social relationships that would enable them to acquire opportunities to interact with colleagues in the lab.

From the above example, it is evident that what has to be focused on, regarding second language learner needs are not only the needs in terms of language, but also the needs in terms of practices. In other words, what I propose to focus on is the needs related to a set of social activities constituting social settings and social realities in everyday life, workplaces and labs. Moreover, from this standpoint of focus on practice, I will demonstrate that language needs also can be considered not merely as language
needs themselves but as part of needs in terms of practices. This notion of language needs perceived as part of needs in practices is the alternative stance I take toward needs and language in this dissertation.

1.2 The problem facing international graduate students of science in Japan

In this section, I will explain why I decided to focus on practice in reformulating (our understanding of) needs. I had taught Japanese in the 1990’s in a Japanese university where the majority of my students were science majors (IGSs). I was interested in clarifying what kind of academic Japanese was needed for IGSs. Thus, I started my fieldwork in a science lab. However, I found that IGSs were presenting their research in English rather than in Japanese in the lab. Also, in order to conduct research there were too many Japanese words and tasks to be learned in the limited period of the intensive language training. Japanese (both faculty and students) used polite form, casual form, and a dialect spoken in the area in their speech, for example, when explaining an
experimental procedure, and in lab's periodic presentations. Thus the vocabulary alone was too vast to be analyzed and itemized by a Japanese teacher. Besides, there was not enough time to teach the necessary words, grammar and other linguistic features used in a lab. Moreover, in the intensive Japanese language training class, specialties of students were almost all different, for example, biotechnology, welding, and nuclear physics. What they need to learn was vocabularies, and tasks related to their experiments in their labs but these were different according to their specialties.

Another important phenomenon I observed was that some international students could not even interact with Japanese members. The problem was not just a linguistic issue, it was about constructing social relations.

For example, I heard from several IGSs in different labs in different fields that they were not invited to informal parties, such as the BBQ party next to a lab building on campus, or that, while working in the lab, the Japanese would order pizzas but would not invite an IGS, who was also there working, to join them. Or, among the IGSs, one smoker chosen not to smoke in the heated smoking room with Japanese smokers. He preferred to
smoke in a corner of a corridor on a different floor, where the winter wind was blowing
trough (the building was designed with open parts.) These cases happened not because
their Japanese proficiency was too low, but because they were not invited to or avoided
the situations where interaction was occurring to begin with.

Thus this lack of interaction means lack of opportunities to use or learn Japanese.

Similar problems were reported in Sawyer & Mito’s (1998) interview study on IGSs
majoring in engineering. Some IGSs pointed out that it is quite difficult for them to
construct social relationships in the lab.

On the other hand, there was one student who had opportunities to interact with
Japanese graduate students, although his Japanese level was not so high at first, and he
was able to obtain their help. As a result, he was able to use the lab machine for his
experiments.

This IGS could fulfill the needs related to his own research by creating social
relationship with Japanese students. At the same time, his Japanese improved
dramatically after he entered the lab upon completing the intensive Japanese program. He
was seen as a successful IGS by his lab members, however, even for him, it was not easy at the beginning. After finishing his 17-week intensive Japanese language course, he could not continue his extra-curricular Japanese class and it was very difficult for him to interact with Japanese graduate students, as we shall see in Chapters 6 and 8.

In this case, how one improved Japanese in what kind of language learning history, was not necessarily important after all. In the end, it was more productive to examine learning by being distant from language learning. This also gave a new perspective for research on IGSs and language learning at the same time. How it was done will be described in the data and analysis section of this dissertation, Chapters 5, 6, 7, and 8. Through my fieldwork, it became clear how opportunities for interaction in Japanese are organized in the lab. This is an important concern for reconsidering the learning of Japanese. Moreover, the issue of how the opportunities to interact in Japanese are attained, or how the opportunities are not attained, is obviously one which clearly goes beyond the mere issue of language use or language learning. That is, for IGSs, the opportunities of interaction in Japanese do not occur by themselves. Rather, the opportunities are closely
related to whether or not they participate in research practice in the lab. Thus the real
picture of the lab life and learning in the lab was quite complicated involving problems
beyond sheer linguistic issues. The problems were that IGSs could not participate in
research practice, which includes various activities such as eating and doing homework
together and situations such as classes and a cafeteria, and using machines in order to
conduct research. Therefore, I determined that there was a need to reconsider the meaning
of learning for IGSs and to focus on practices and reformulate the concept of needs from
its foundation. In the next section, drawing on situated learning theory (Lave & Wenger,
1991; Wenger, 1990 & 1998), I will examine what a practice is, and what it means to
participate in a practice.

1.3 Focusing on practice

The situated learning theory developed by Lave & Wenger (1991) and Wenger
(1990, 1998) is very powerful when attempting to clarify how social relations are
constructed as something is being produced in a certain place, how opportunities for

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interaction are organized, and how social activities are organized. It is compelling because it reformulates learning from perspective of social theory. In the following, the notion of practice as construed by situated learning theory will be illustrated with examples from fieldwork studies. The detail of this theory will be explicated in Chapter 2, however, as a preview, I will provide a brief introduction in this section.

Activities in which people are collaboratively and socially engaged in producing something or orienting activities toward some place (an activity which does not produce anything, such as navigation at sea) while using artifacts are called "practices" (Lave & Wenger, 1991; Wenger, 1990 & 1998). In accordance with the activities producing something or activities orienting toward something, a social group and artifacts are organized in a specific configuration. In such cases, this social group can be called a community of practice (hereafter CoP, Lave & Wenger, 1991; Wenger, 1990 & 1998). Artifacts here mean tools and technology utilized in activities producing something or in activities oriented toward something.

Lave & Wenger (1991) illustrate CoPs with the examples from a wide range of
settings where learning through apprenticeship is being undertaken: such as tailors in Liberia, team navigation in the U.S. marine, midwives in Yucatan Peninsula, and butchers in the U.S. According to Lave & Wenger, in the case of the Liberian tailors, workers are assigned to various jobs such as the sewing of ornaments, buttons, and various parts, and the cutting of the material in the process of garment production. The various tools necessary in the process are also juxtaposed accordingly.

According to Lave & Wenger (1991), the social group organized for garment production in Liberia is a CoP. As shown in the above examples, a CoP is not merely an institutionalized group of people, such as a community consisting of neighbors, a department in a corporation, a class in school, nor a family. Rather, in a CoP, the members of the community are sharing a specific practice. More importantly, this garment production community is organized in a specific way according to production process and configuration of artifacts utilized for production rather than merely organized as a social group.

A second related example is reported in Edwin Hutchins (1990). According to
Hutchins, navigation of a large ship is managed by a social group of quartermasters consisting of such workers as a bearing timer recorder, a bearing taker, and a plotter. In order to plot their ship's position, they use various artifacts such as charts, alidades, or monograms. Hutchins points out that the navigation of a large ship is conducted by the ensemble of the artifacts and the navigation team. That is, in this case, this cognitive activity of positioning their ship can be regarded as one kind of practice. This activity is accomplished through the collaboration of the team and artifacts.

In a nutshell, practice is an activity of completing something collaboratively and socially. I will provide more elaborated explanation in Chapter 2. This navigation team can be regarded as a CoP, just as the tailors in Liberia. This is because people in each community share a practice. Further, the community is organized according to the task of navigation and the configuration of artifacts utilized there. In a science lab, which is the focus of this study, the members participating in the lab also are collaboratively and socially engaged in producing something by using artifacts. Thus members in a science lab share a practice and this community (or better, the ensemble of individuals and...
activities through which this joint production is carried out) can be regarded as a CoP.

Whether it is a case of tailors, a navigation team, or a science lab in a university, social interaction or language use do not exist by themselves in a vacuum. Language use is vital but only one part of practices such as garment production, navigation and scientific research. Thus without focusing on practice, the ways in which social interaction and language use are organized cannot be clearly understood.

Focusing on practices as an approach to reconsidering L2 learner needs means shedding light on needs in practice and participation in a CoP. Needs in this case are, to have opportunities to participate in interaction for producing something, or for orienting toward something, such as navigation. In the following, the perspective of situated learning theory, which focuses on practice, will be explicated briefly. Then I will demonstrate the re-conceptualization of needs.

1.4 Learning as access, participation and identity formation

In 1991 version of situated learning theory, Lave & Wenger were mainly
concerned with learning in apprenticeship situation. Learning requires “access to a wide range of ongoing activity, old-timers, and other members of the community; and to information, resources, and opportunities for participation” (Lave & Wenger, 1991, p. 101). According to situated learning theory, learning is regarded in terms of participation in a CoP, and as something that co-occurs with identity formation. Participation in a CoP can be defined as “accessing” ongoing activities and resources that are socially organized and controlled by members of a CoP. This access to activities includes access to artifacts such as machines used in that activity, and access to people who are involved in the activities.

In the case of the Liberian tailors, according to Lave & Wenger (1991), apprentices could view the whole steps of making a garment according to their level of mastery. For example, apprentices started from attaching buttons, then sewing parts together, and finally cutting out the pieces.

This kind of steps of work was juxtaposed in the open space. Thus apprentices could observe the steps they were going be engage in, in the future. This enabled them to
access the garment production activity. This visibility provided them with the opportunities to observe steps they would engage in, in the future, and to identify their own position in relation to the whole process of becoming a full-fledged tailor.

On the contrary, in the case of supermarket butchers (e.g. Lave & Wenger, 1991), newcomers were assigned to engage only in meat wrapping (unskilled work) in a sequestered room. Therefore, they could not observe old-timers engaging in skilled work such as meat cutting. Thus, newcomers could not access meat processing practice. In this case, thus, the physical walls of the room prevented apprentices from accessing the practice. As a result of this lack of access, apprentices could not have opportunities of observing meat processing.

According to situated learning theory, access to resources and activities is socially organized, including this kind of design of space. For example, access is organized through allocating members a specific space, organizing division of labor in a certain way, and/or being managed by a gatekeeper who controls access.

As shown earlier, in the science lab I studied, one of the problems an international
student faced was difficulty in using the machines for conducting experiments. This problem was ostensibly caused by a Japanese member who was managing the machine. He scheduled this international student's machine use time in a way which made his machine use very difficult. This difficulty of using a machine can be rephrased in terms of the situated learning theory, as an issue of an IGS's access to resources. This example is a typical case illustrating how access to a machine is socially organized.

In situated learning theory, access to resources and activities are related to one's participation in a CoP. According to Lave & Wenger (1991), participation in a CoP is defined as becoming a member in a CoP. By being accepted as a member, access to various activities and resources becomes possible. One's ways of accessing various activities and resources thus illuminate ways of participation or non-participation in a CoP. In other words, one's ways of access to various activities and resources indicate whether she is as a member of a CoP or not.

In the case of Jordan's Yucatec midwives (cited in Lave & Wenger, 1991), a daughter of a midwife helps her mother out in a variety of peripheral tasks associated
with the performance of her role as a midwife. However, she would not be given access
to be engaged in midwifery work directly until she herself experiences childbirth. The
extent to which the daughter has access to full participation in the CoP is shown in
whether it is possible or not to access the most important work of a midwife. That is to
say, accessing the most important work in midwifery is only possible when she becomes
a full participant (Lave & Wenger, 1991, p53) in a CoP. The similar case can be found in
the lab CoP I studied, as well. Whether one can access an experimental machine or not
illuminates his way of participation in a CoP. By becoming a member in a CoP, access to
a machine will become possible. Thus access to activities or resources and participation
in a CoP are two sides of the same coin.

Moreover, becoming a member in a CoP and gaining access to activities and
resources are related to the issue of one’s identity formation (Lave & Wenger, 1991, p. 53
& pp. 110-112). That is, in a CoP, being able to access certain activities or resources also
indicates who one is, and what kind of position one occupies in that CoP. This kind of
positioning of oneself in a CoP cannot be managed or manipulated by the individual

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alone, but is mutually accomplished by interaction with the other members in the CoP.

Thus, participation in a CoP, and its concomitant identity formation, can be regarded as collaborative work exactly as practice itself.

Moreover, in situated learning theory, "learning" is formulated as situated and socially organized. According to Lave & Wenger (1991), knowing or being able to do something cannot be defined independently of a certain practice. Learning cannot be separated from one's access to a certain activity or resources, one's position in a CoP, and its concomitant identity formation. In other words, what one can do, or what one becomes able to do, is not a matter of an individual's attainment of knowledge and/or skills, but is rather a "whole persons" issue (Lave & Wenger, 1991, p. 53) that includes change in a way of participation and/or acquiring a certain position.

Learning according to situated learning theory is thus something that can be indicated as a way of participation, a possibility of access to activities and resources, and something related to identity formation. It is not something that can be reduced to acquisition of certain knowledge or skills. Moreover, even if one possesses certain
knowledge or skills, this learning cannot be construed as an individual’s ability. Rather, both knowledge and skills are socially-constructed and, in certain situations, may have social value. This kind of socially valuable knowledge or skill can be called “intellectual capital” borrowing the term of Bourdieu (1977). As I will introduce in detail in Chapters 5 and 8, certain knowledge or skill could become capital in a CoP. For example, in the lab I studied, a Japanese student had skill in using a lathe and mill machine to process metal, or an international student had English skill, their skill and knowledge is useful and valuable for lab members. Thus, certain knowledge and skill have social value in certain situations.

In this study, I adopt situated learning theory as my theoretical framework because of its obvious strength, which is its wide scope toward learning. Besides viewing learning as a social endeavor, it includes not only the interaction among people, but also that between human beings and artifacts. However, previous research that has used situated learning theory as a framework (Lave & Wenger, 1991; Wenger, 1990; Wenger, 1998) has not directly shed light on learners’ needs. Moreover, the existing situated
learning theory studies do not address language as practice or language in practice as a
central issue, although there are some examples dealing with language, such as the
language of participants at AA (alcoholic anonymous) meetings, midwives, and copy
machine technicians (Lave & Wenger, 1991). In order to deepen our understanding of
learning from the perspective of situated learning theory, it is vital to investigate these
issues.

In Chapters 6, 7 and 8, I will analyze ways of access from the perspectives of both
IGSs and the Japanese members of various backgrounds in the lab. This analysis from
multiple perspectives provides dynamic explication of how access (or learning) works in
real practice.

Although a new perspective on learning was suggested by Lave & Wenger (1991),
they do not shed light on how learner needs can be conceptualized. In the discussion that
follows, I will demonstrate that a focus on learner needs is compatible with the
framework of situated learning theory, and that the framework itself does provide the
resources to conceptualize learner needs.
From the viewpoint of situated learning theory, learner needs can be construed as access to various resources and activities in a CoP. In other words, responding to the needs of learners means enabling participation in a CoP. When accessing various resources and activities in a CoP is difficult or prevented, that is obviously a serious problem for learners because they are deprived of opportunities for learning. In the case of the science lab I studied, the needs of IGSs are, how to be able to access artifacts such as machines and various activities or occasions such as sharing the experience of studying for exams and complaining about their lab. This issue of access can be improved much by arranging various activities and occasions. In other words, needs can be responded to by the design of the environment where participation in the lab CoP is facilitated.

In fact, being able to access machines and various activities related to research is central and indispensable to research practice in experimental science. Thus they are the most basic needs for IGSs. The biggest problem for the IGSs I studied was that they could not access machines and various activities in their lab. When they could not access
machines and various activities (both formal and informal activities which I will introduce in Chapter 5, 6, 7 and, front stage and back-stage activities in Chapter 8), opportunities to interact with the members in the CoP were similarly scarce. In regard to learning of Japanese, the limited opportunities for interaction made opportunities for learning of Japanese scarce as well. Thus the possibility of access to machines and activities in the CoP, provides rich opportunities of interaction. Moreover, these also are the opportunities to learn Japanese language. Therefore, by scrutinizing what kind of things enable access toward machines and activities for IGSs and what hinders their access, how to address IGSs needs should also become clear.

1.5 Design of learning environment: ways of responding to needs

As was mentioned above, situated learning theory (Lave & Wenger, 1991) has not directly addressed learner needs issues in a concrete manner. However, “design for learning environment” perspective of this approach provides directions toward how to respond to learner needs. In this section, first, I will introduce the idea of “the design for
learning environment,” then I will discuss how to respond to IGSs’ needs following this perspective.

According to situated learning theory, there are at least two ways of viewing learning (Lave & Wenger, 1991, p. 97). One way is from a perspective of a learning curriculum and the other is based on a teaching curriculum. A learning curriculum is a learner-centered view of learning. According to Lave & Wenger, “A learning curriculum is a field of learning resources in everyday practice viewed from the perspective of learners.”

On the other hand, a teaching curriculum consists of items that are supplied by the teaching side in the form of prescriptions about proper practice. It is an external view of what knowing is about. The distinction between a learning curriculum and a teaching curriculum implies different perspectives on learner needs and what should be prepared for learners. Thus from a teaching curriculum perspective, a teaching method for learners must be designed. That is, for this design for pedagogy, based on a cognitive psychology model, a series of teaching procedures to increase skills and competence needs to be
chosen, elaborated, and improved for learners as individuals.

On the other hand, for a learning curriculum, what is needed is a design for the learning environment. As Wenger (1998) says, "The first requirement of educational design is to offer opportunities for engagement" (p. 271). This design for the learning environment is based on situated learning theory, and it implies designing support resources, social organization, and opportunities for participation in a CoP, resulting in access to practices (Wenger, 1998, pp. 263-277).

How would the needs of IGSs be viewed from the design for pedagogy vs. the design for learning environment perspectives? From the design for Japanese language pedagogy view, needs would be defined largely in terms of particular language and grammatical patterns or interactional patterns necessary for lab life, notably for research. IGSs' needs would be satisfied by designing a teaching method for linguistic items to be taught in the classroom. However, as mentioned earlier, the ideal target Japanese discourse for determining the needed language did not exist in the lab that I observed. The language of the lab's periodic presentations and feedback was English. Moreover,
some of the IGSs did not have opportunities to interact with Japanese students, a more serious problem than lacking specific linguistic resources.

From the design for learning environment perspective, on the other hand, IGSs’ needs consist of access to a variety of activities, situations, opportunities, various artifacts such as machines, and gaining a particular position in a science lab. These opportunities for language learning and use do not exist in and of themselves, but rather are embedded in the participation in the CoP. Fulfillment of the needs of IGSs can therefore not be best achieved through the teaching of particular linguistic items of a design for pedagogy, but by arranging various activities, situations, opportunities, and machines to support participation in the lab CoP.

By following the design for learning environment perspective, the needs of IGSs for participation in a CoP, such as collaborating with other lab members, conducting research, and promoting science, are most likely to be addressed. Furthermore, without such opportunities for interaction in the lab and the resulting learning and language use opportunities, IGSs’ needs cannot be satisfied.
1.6 The purpose of the research

With situated learning theory employed as a theoretical framework, the purpose of this research is to begin to clarify IGSs' needs by showing in a detailed and concrete manner how IGSs participate or are unable to participate in the lab CoP. Such clarification will facilitate the design of a learning environment which will address their needs. IGSs' ways of participating in a community will be examined by focusing mainly on the points below.

First, according to situated learning theory, "participation" in a particular CoP consists of participation in and access to mutually related multi-layered activities and situations. We thus need to answer the following questions: How are the participation in and access to mutually related multi-layered activities and situations organized in participation in a lab CoP? How is the participation in multi-layered activities and situations related to each other?

Second, according to recent developments in situated learning theory (Lave, 1997;
Dreier, 1999), participation in a CoP consists of not just participation in a single CoP, but in multiple CoPs. Thus, participation in a CoP involves crossing multiple CoPs. This crossing of multiple CoPs is called “trajectory of participation in CoPs” (Lave, 1997). Thus, a participant’s way of participation in a certain CoP depends on the nature of the particular CoP. IGSs who are the target of this research are people who have crossed between multiple CoPs. How do ways of IGSs’ participation depend on their previous or concurrently existing CoPs? What kind of CoPs are these other CoPs?

An examination of these points will clarify IGSs’ ways of participation in the lab CoP and provide a framework for a NA for IGSs in terms of design of learning environment.

1.7 Research method

The main purpose of this research is to reformulate IGSs’ needs by focusing on practices. In more concrete terms, the purpose here is to reconceptualize IGS’s needs as facilitating participation in a CoP, and thus access to machines and activities in the CoP.
For that purpose, I will clarify how IGS's access toward machines and activities is possible, and how this access is often hindered or prevented and by whom in reality. In order to shed light on these issues, it is necessary to view ways of practice in a lab in detail, and to view how a CoP is organized.

These issues will not become clear by general questionnaires or interviews, which are away from the field. For example, although it is possible to find out pieces of information about what is difficult or what is the problem of IGSs by these methods, how these problems occur cannot be thoroughly clarified by these methods alone. In addition, even in the cases where IGSs can access various resources and activities, the process of how it became possible is not clear. In order to scrutinize learning in a CoP, a qualitative approach was indispensable because of the organic relationships among many people, their experiences, and artifacts, which all interacted day-to-day to create learning and a learning environment.

Thus in this study, I employed ethnographic method. I entered a science lab, and observed and interviewed lab members repeatedly. By analyzing these observations and
formal and informal interviews, I tried to elucidate what practices are and what the lab CoP is, and how access to various resources and activities are organized.

1.8 The structure of this dissertation

The dissertation is organized as follows.

In Chapter 2, the theoretical framework of situated learning theory, particularly the concept of CoP and related vital concepts, will be outlined and elaborated, and relevant research will be reviewed. First to be discussed will be how to make connections between artifacts, language, and practice; and second will be the issue of how community can be formulated. Third, the issue of how language itself can be regarded as practice will be presented.

Chapter 3 will focus on NA, and how it has been conceptualized and implemented. NA in general will be discussed, followed by analyses of language needs. Language for specific purposes, including Japanese as the academic language, will be reviewed. Finally, the needs of IGSs will be reconsidered from the situated learning theory perspective.
In Chapter 4, the methodology employed in this study will be explained. The site for this study (a university science lab), the participants, and ethnographic fieldwork as the chosen research method will be elaborated on.

In Chapter 5, the situated nature of scientific practice will be illustrated by comparing it with the daily practice of cooking. Scientific practice is often popularly misunderstood as a very solid practice producing the same results every time the same experiments are conducted under the same specifications. However, on its cutting edge, scientific practice is quite fragile, and full of contingencies of unknown factors and luck. Diligence, vigilance, and endurance in running and re-running experiments using the same materials and procedures are indispensable in this practice as well. It can (and will) be analogized to the more mundane difficulty in trying to recreate a bread pudding of the exact same characteristics. In this chapter, I will present to demystify the nature of experimental scientific practice, and should help readers understand the context for the situations to be reported in Chapter 6.

In Chapter 6 I will scrutinize the case of a European IGS, Karl, who failed to gain
access to the lab’s shared machine, and contrast this experience with the case of another European IGS, Max. With this comparison, the nature of the networks of each of the two IGSs will be revealed. The simple table of activities of the lab briefly introduced in Chapter 5 will be used again to help readers understand clearly the differential access of Karl and Max to vital resources in the lab.

In Chapter 7, the table of activities used to help understand the differing trajectories of the IGSs will be reexamined. The activity table, which represents an institutional perspective, will be reanalyzed from a perspective of participants by using Goffman’s (1959) notions of frontstage/backstage. This shift in perspective is helpful to understand the dynamic nature of the lab CoP more deeply. The organization of various activities and of lab members will be examined through this lens, and the concept of frontstage/backstage will also be introduced in order to understand ways of participation in a CoP more concretely, as well as to shed light on the dynamics of power relations in the lab.

In Chapter 8, the puzzle of Karl and Max’s respective participation and
non-participation in relation to their identity will be further examined from an additional perspective. I will employ the notion of symbolic capital (Bourdieu, 1977) to explain why Karl, who could speak English near-natively, could not utilize his linguistic capital, while Max, who was not a proficient speaker of English (upon arrival to Japan), became accepted by Japanese lab members as Max, the “English guy.” The differences in trajectories will then be discussed more widely, along with additional cases (Fumiko and Jun), in terms of identity formation and the effects of belonging to multiple CoPs. In the concluding chapter, a new type of curriculum development will be proposed, consistent with a situated learning perspective and the findings from this study. An approach emphasizing “design of learning environment” for language learners will be compared with the now dominant “design of pedagogy.” The implications of this shift in perspective, and the contributions of the study as a whole will be discussed.

In the concluding chapter, a new type of curriculum development will be proposed, consistent with a situated learning perspective and the data from this study. An approach emphasizing “design of learning environment” for language learners will be
compared with the now dominant "design of pedagogy." The implications of this shift in perspective, and the contributions of the study as a whole will be discussed.
2.1 Introduction

To restate the purpose of this paper, it is to explore IGSs’ needs by focusing on their daily practice and their ways of participation in the lab CoP. In this chapter, in reviewing the most relevant research, I will discuss in more detail the theoretical framework of situated learning theory introduced in Chapter 1. As I already mentioned, the purpose of this research is to clarify IGSs’ needs by showing concretely how IGSs participate or are unable to participate in the lab CoP. Such clarification will facilitate the designing of a learning environment that addresses their needs. In this chapter, first of all, I will review the framework of situated learning theory. Then, focusing on five questions, I will review research related to situated learning theory. The first of the five questions is “what is community of practice?” The second question is “what is the relation among artifacts, access and participation?” The third is “how does situated learning theory formulate the relation between discourse and practice?” For example, I will consider how
discourse itself can be regarded as practice, and how discourse itself can be regarded as
something embedded in practice. The fourth question is “how are identity, position and
capital formed and made visible through one’s participating in a CoP?” The fifth question
concerns designing curriculum for learners. I will present how an understanding of
curriculum and its design are formulated within situated learning theory. The viewpoint
of situated learning for designing curriculum will provide clues for how to respond to
IGSs' needs, once they have been identified.

Finally, in addition to my discussion of these five questions, I will also introduce
criticisms and discussions of situated learning theory in the following sections. These
criticisms and discussions include the implications for the possibilities of situated
learning theory and this enable us to develop the theory further. At the same time, these
criticisms and discussions facilitate a practical perspective for exploring needs The above
points provide us with an overall perspective on exploring IGSs' needs in laboratory life
and in everyday life.

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2.2 Community of practice

Practice

As it was stated in Chapter 1, a practice in situated learning theory can be defined as a set of collaborative and social activities producing something or orienting toward some place in everyday life, in workplaces, and in research labs. An example of producing something has been shown in the activities of tailors (Lave & Wenger, 1991) and an example of orienting toward some place has been shown in team navigation (Hutchins, 1990).

Other cases of practices include activities of maintaining, managing, and caring about something (for example, the case of copy machine repair technicians reported by Orr (1996)), or performing something (such as music), or conducting research and development. In sum, a practice is an activity of accomplishing something collaboratively and socially.
Community of practice

When a practice is what is defined above, then a CoP can be defined as a social
group organized for practices such as producing, navigating toward somewhere,
maintaining, managing, and caring about something, performing something, and
conducting research and development. Then a CoP is not merely a community consisting
of neighbors or an institutionally defined group of people such as a department in a
company, a class in a school, or a family (Wenger, 1990).

To be more specific, institutionalized units such as a department, a class, or a
family are not CoPs as they are. Rather, they can be resources or constraints for
organizing CoPs. Wenger (1990, p. 151) has pointed out that “structures in the world,
including social and cultural forms, do not determine behavior; they are resources as well
as constraints.”

For example, institutional units such as a department, a class, or a family,
sometimes provide a space to share a specific practice. On the other hand, the boundary
of an institutional unit can prevent members from sharing practice. In this sense, an
institutional unit can become a resource or a constraint. According to Lave & Wenger, the term community does not necessarily imply “co-presence, a well-defined, identifiable group, or socially visible boundaries.” However, “it does imply participation in an activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their communities” (1991, p. 98).

Wenger’s (1990) description of a CoP is rather lengthy, but worth quoting since CoP is a vital part of this study.

The critical point that makes them a community of practice is that they share a way of “going about doing some things” and that they share it because they have come in contact with each other, either directly or indirectly, through physical copresence or through some other ways. In other words, they share a practice: this includes activities they all engage in, specific ways of communicating about these activities they share, and as a result some perspectives and interests (in both senses) they have in common. This concrete aspect of sharing a practice is crucial in making the concept of community of practice analytically robust: because it is defined by this shared practice, which takes place in the lived-in-world, the concept of community of practice does not presuppose any of the structural features that it can be used to explain.

(PP. 145-146)

Thus a CoP is constituted and reconstituted according to the situation, in sharing a
practice using an institutionalized framework as a resource. Taking an example from my own research, a lab community in a university, does not necessarily comprise a CoP. It is a CoP only in conducting real practice such as a research project, and only while doing various kinds of negotiations. A CoP is also a community organized using an institutional framework as a resource. The details of various aspects of a CoP will be discussed in 2.3, 2.4, and 2.5 along with describing concrete cases.

Learning in a CoP

According to situated learning theory, learning is organized and structured in a CoP. In fieldwork research based on situated learning theory, the research foci are on issues such as how a particular CoP is organized, how a practice is shared, and how each member participates in the CoP. These comprise the aim of the research of situated learning theory. That is, research based on situated learning theory is attempts to concretely clarify how learning in a particular CoP is organized and structured through focusing on these issues.
The purpose of this research is to explore IGSs’ needs by studying their daily lives and practice in a university science lab. In conducting research for these purposes, the framework of situated learning theory provides very relevant and useful clues as for what to study in the field and how to examine it. In the following section, I will look at the theoretical point of view of situated learning theory in more detail, in order to examine how a CoP and participation in a CoP are organized.

2.3 Artifacts, access and practice in CoP

In this section, I will examine the issue of the relationship among artifacts, access, and participation in a CoP. The issue of artifacts in practice has significance in this dissertation because it is deeply related to the issue of access, which as we have seen is indispensable for learning in a CoP. Two studies (Street, 1984; Wenger, 1990), which I will introduce here, illustrate how artifacts and access are related to each other.
Participation and access

Lave & Wenger (1991) raise a question about the traditional view of apprenticeship that is learning practical skills by “observation and imitation”. They stress that participation in a CoP provides more than observational lookout, as should be clear from the following excerpt:

To begin with, newcomers’ legitimate peripherality provides them with more than an “observational” lookout post: It crucially involves participation as a way of learning – of both absorbing and being absorbed in – the “culture of practice.” An extended period of legitimate peripherality provides learners with opportunities to make the culture of practice theirs. From a broadly peripheral perspective, apprentices gradually assemble a general idea of what constitutes the practice of the community. This uneven sketch of the enterprise (available if there is legitimate access) might include who is involved; what they do; what everyday life is like; how masters talk, walk, work, and generally conduct their lives; how people who are not part of the community of practice interact with it; what other learners are doing; and what learners need to learn to become full practitioners. It includes an increasing understanding of how, when, and about what old-timers collaborate, collude, and collide, and what they enjoy, dislike, respect, and admire. In particular, it offers exemplars (which are grounds and motivation for learning activity), including masters, finished products, and more advanced apprentices in the process of becoming full practitioners.

(Lave & Wenger, 1991, p. 95)

In other words, newcomers are learning a variety of things such as how to work,
how to use artifacts in work, how each work is mutually related, and they are learning the whole structure of work, through accessing various situations of practice. As Lave & Wenger put it, the crucial element is “access to a wide range of ongoing activity, old-timers, and other members of the community; and to information, resources, and opportunities for participation” (1991, p. 101).

As was mentioned in the previous chapter, from a situated learning theory perspective, access to resources and activities are related to one’s participation in a CoP. According to Lave & Wenger (1991), participation in a CoP entails becoming a member of a CoP. One’s ways of accessing various activities and resources illuminate ways of participation or non-participation in a CoP. Access to various activities and resources is legitimately guaranteed and becomes possible by being a member. One’s ways of access to various activities and resources indicate whether one is accepted as a member of a CoP or not. Therefore, participation in a CoP can be defined as “accessing” ongoing activities and resources that are socially organized and controlled by members of a CoP. This access to activities includes access to artifacts such as machines used in that activity, and
access to people who are involved in the activities.

However, a CoP does not always guarantee newcomers’ access. Concerning this issue, Lave & Wenger cite Becker (1972): “Becker raises a serious new set of concerns about the issue of access. He recognizes the disastrous possibilities that structural constraints in work organizations may curtail or extinguish apprentices’ access to the full range of activities of the job, and hence to possibilities for learning what they need to know to master a trade” (Lave & Wenger, 1991, p. 86).

The case of supermarket butchers (Lave & Wenger, 1991) illustrates this point well. In this case, newcomers were assigned to engage only in meat wrapping in a sequestered room. Therefore, they could not observe old-timers engaging in skilled work such as meat cutting. Thus, newcomers could not access meat processing practice. In this case, the physical walls of the room prevented apprentices from accessing the practice.

It is possible to say that this design of the workspace represented division of labor, social organization and the institution. In other words, the form of division of labor of butchers prevented apprentices’ access to practice. The access of an apprentice depends
on the nature of the division of labor in the social environment in which the CoP is
embedded (Lave & Wenger, 1991, p. 92).

Contrary to this case, the tailors in Liberia were working in open space so that
apprentices who started from the buttoning process could observe the whole process even
if they were not in charge (Lave in preparation, in Lave & Wenger, 1991). Thus in these
tailor shops, the work process was designed in such a way that apprentices could access
the practice.

From the above examples, it can be seen that learning happens through accessing
practice. In more concrete terms, through accessing various situations of practice,
newcomers learn such things as how to work, how to use artifacts in work, and they are
learning the whole structure of work and how each unit of work is mutually related to
others. In other words, knowledge and skills are not something that reside in an
individual, such as a master. Rather, they reside in a CoP, as Lave & Wenger write in the
following excerpt.

... mastery resides not in the master but in the organization of the community of
practice of which the master is part: The master as the locus of authority (in several senses) is, after all, as much a product of the conventional, centered theory of learning as is the individual learner. Similarly, a decentered view of the master as pedagogue moves the focus of analysis away from teaching and onto the intricate structure of community’s learning resources.
(Lave & Wenger, 1991, p. 94)

Thus from the situated learning theory perspective, to understand learning in a
CoP is first to clarify what structure of community’s learning resources enables access or
hinders access. Second, it is to clarify how access to activities and resources is organized.

Access and artifacts

In discussing artifacts, one of the central concepts in Wenger (1990, p. 102) is the
notion of “cultural transparency.” The meaning of an artifact is not clear by the existence
of an artifact itself. Its meaning becomes clear only when one can see the context in
which the artifact is located and utilized. In order to illustrate this point, Wenger (1990)
uses a Coca-Cola bottle dropped into the African Bushman society in the movie “The
Gods must be Crazy” as an example. When a Coca-Cola bottle is placed in this different
culture, this well-known artifact is not culturally transparent any more; how the glass bottle is made, what kind of image people have toward the drink and the company that makes it, or the caffeine- and sugar-rush associated with the drink-what Wenger calls the “real thing”—is unknown in the African Bushman society. Therefore, the glass bottle is no longer transparent.

In a CoP, members use artifacts. Some artifacts are vital and/or symbolic to their practice there. A nomogram and alidade (a special telescopic sighting device) for quartermasters are examples of artifacts in practice. About cultural transparency, Wenger writes that the emphasis is on “the relational, culturally defined, locational, perspectival character of knowing in practice. In this case, participants of this practice can access to activities in which these artifacts are located, utilized and talked about. By doing so, artifacts become transparent for participants. On the other hand, when one cannot access activities in which an artifact is located, the artifact is not transparent for her/him. Wenger, borrowing the term from philosophy of science, refers to an artifact that is not transparent as a “black box”. In other words, if one cannot access activities in which an artifact is
located, utilized and talked about, the artifact becomes a "black box". I will come back to this term in the section called "Wenger’s 1990 Study" after the next section.

Two studies I will introduce here are contrasting cases concerning cultural transparency. Street’s (1984) study is a case of artifacts being culturally transparent, whereas Wenger’s (1990) study is the case of an artifact being a black box to members of the CoP. These are studies in which the issue of the relationship between artifacts and access are studied concretely.

The research of Brian Street

An anthropologist, Brian Street, studied the development of the fruit market in a village in Iran (Street, 1984). He found out that artifacts such as bookkeeping records, personal checks, and other documents were developed and started being used as the village’s distribution and exchange system went through reorganization. The reorganization of the distribution and exchange system in this village was as follows.

In this village, at first, fruit farmers used to go to a city individually to sell fruits.
At that time, in Iran, the market for fruit was growing due to an oil boom. As the growing of fruits for the market developed, some farmers became brokers called *Tajer*. These brokers started buying fruits from fellow farmers in the village and selling them in bulk to wholesalers in urban areas, or to canning factories for fruit jam.

Along with the emergence of these new brokers, new artifacts emerged. For example, these brokers created their own account book system by using elementary school notebooks. The account book system developed along with a special account book literacy, which was a transfer of religious literacy, known as the *Maktab* literacy from the Qur’an. The literacy forms that appeared with this organization of the product distribution practice were not limited to account books. They included other artifacts such as checks, notes, account statements, thumbmarks, and signatures. Therefore, in the product distribution practice, villagers became familiar with the treatment of checks, notes, account statements, account books, and signatures, all of which became part of everyday life for the participants of this product distribution practice. That is, mere pieces of paper like checks, account statements, and signatures became as valuable as money.
among villagers and became treated as such. For example, during the fruit season, the Tajer often carried thick wads of checks worth several thousand British pounds. In this way, their social status was displayed in public by showing the amount of money they dealt with.

As the fruits from this village started being sold in wider areas, villagers needed to develop a system to record transactions of products and money. Account books and other formats of artifacts were a part of the distribution and exchange system. The design of documents such as account books was included as an indispensable part in the distribution and exchange system. This medium was part of a social network of mutual surveillance and mutual accounting.

This case elaborated in Street (1984) illustrates that the development of literacy is inseparable from organizing a practice where various artifacts are utilized, from constructing a social system of practices, and from participating in those practices. Knowing how to use these artifacts and learning how to read and write includes participation in a certain activity and learning how the activities are organized.
For example, an account book is sometimes used for personal records such as housekeeping expenditures, but generally it is used as a tool which makes the flow of cash and commodities “visible” to a certain group of people. Accountancy or accounting means “to account,” to explain. Thus an account book emerged along with the collaborative management of the flow and amount of commodities and money, and the management of group economic activity. It can also be said that an artifact such as an account book is embedded in a social practice such as management activities.

For the reasons given above, in order to develop an artifact such as an account book, one first has to participate in the activity of that particular social organization. In order to develop an account book, one has to understand the movement of commodities, money, and people in real life, and to understand account books in relation to other kinds of documents which index the states of commodities, money, and people. That is, when an account book is not situated in the network of various other documents and resources, it is a fragment and an incomplete tool.

Street’s (1984) study also illustrates the point that “general and abstract literacy”
does not exist. According to Street, college students from this village could read novels. However, these college students who are widely expected to be literate could not read account books. The college students did not understand at all how the distribution system worked, and what the social organization of mutual surveillance and mutual accounting were. Being able to “read” account books and participating in the distribution and exchange system were inseparable. What this study indicates is that new artifacts like an account book or new literacy are not formed in abstraction. They are formed in accordance with the formation of the new practice and new social organization.

The people who were involved in the fruit business in Street’s (1984) study were participating in the practice of fruit marketing; thus for them an account book, an artifact used in their practice, was culturally transparent. On the other hand, for university students who were not participating in this practice, the cultural meaning of the account book was not transparent. They could not access its meaning because they did not participate in the fruit business practice; thus they did not understand the context it was embedded.
To interpret what we have seen from the issue of access, it can be said that whether to be able to read an accounting book or not depends on whether or not one can access fruit market business. For the people who had been engaged in fruit distribution, artifacts such as an account book are culturally transparent. However, for the villagers who were in college, could not access distribution practice and for them, the account book was a black box.

**Wenger’s 1990 Study**

Wenger’s (1990) study of claim processors (CP) in an insurance company focuses on an artifact embedded in a CoP. In contrast to business people in Street’s study, CPs in Wenger’s study could not understand the cultural meaning of the artifact they were using everyday.

According to Wenger, CPs at Alinsu, the insurance company where he conducted his fieldwork, did not understand the relation between the way of coordination among insurance companies and the way of calculating formulae for customers who contract
with multiple companies. The formulae for calculation were written on a sheet known as
a COB (coordination of benefits) sheet.

When their customers complained about the amount of money they received from
Alinsu, CPs could calculate the numbers but they could not explain why customers
received that amount of money. In other words, the COB sheet was a black box for CPs.

According to Wenger (1990), a black-box is an artifact whose cultural meaning is
not transparent because one cannot access the activity where that artifact is utilized (p.
96). Wenger analyzes the CPs’ participation or non-participation in different CoPs as
related to the fact that the COB sheet was a black-box for CPs. Unknown to the CPs,
there were associations of insurance companies, medical doctors, and other networks
behind the COB sheet that CPs were using every day. The COB sheet was the product of
coordination and negotiation among these various organizations. Once the COB sheet
was represented as a set of calculation formulae, the various networks, organizations,
coordination, and negotiation became invisible. On the other hand, CPs understood their
work in a practical manner, as processing claims as fast as they could, and they did not
attempt to access the various organizational networking, coordination, and negotiation behind the COB sheet.

In sum, behind the artifact, the COB sheet, there were rich networks and other relations. Although the COB sheet enabled easier calculation, it made the network and other relations behind it invisible. Both Alinsu and CPs mutually organized non-participation so that the networks and various relations became invisible, and the company side “sequestered” CPs from the networks and various relations, preventing the CPs’ access to them. Thus, according to Wenger, the understanding of the calculation procedure by CPs was not simply that they did not understand the meaning of calculation. It corresponded with the limited access (sequestering) to their networks and various relations, or non-participation. The company side sequestered CPs from the community beyond their department and limited their access to various relations. On the other hand, the black-boxing COB sheet (the calculating procedure) made the communities and various relations behind it invisible. This black-box confined the CPs’ access to the community beyond their department and various relations, and thus served as a resource
for organizing non-participation in other CoPs.

The way of understanding a COB sheet by CPs is a problem of understanding practice. What Wenger illustrated is the importance of cultural transparency and accessibility in learning in a CoP, and more importantly, how that cannot be studied without examining the actual practice. We need to focus on practices because only through looking at the way of members’ participation and non-participation in a CoP can we fully understand the way a certain learning takes place.

Thus far, the issues of the relationship of artifacts, access and participation in a CoP have been examined. The two cases illustrated how artifacts are embedded in practice. Street’s study was a case in illustration of how participation enabled cultural transparency of the artifacts. This was shown by the contrasting cases of fruit market business people and university students. Whether or not participating in the fruit business practice made the difference between these two groups’ understanding of artifacts.

University students could not access the fruit business practice without participation; thus they could not access the meaning of the artifacts in context. Wenger’s study illustrated
how participating in practice alone is not enough to facilitate learning. CPs did not have access to the network behind the COB sheet, the vital and symbolic artifact in their practice. The artifacts in Street’s study were culturally transparent to the participants in the fruit business, but the artifacts in Wenger’s study were not. Artifacts such as machines are vital and indispensable in a science lab’s practice. I will examine this issue of artifacts in practice thoroughly in Chapters 5 and 6, and will add further perspective in Chapters 7 and 8.

2.4 Discourse as practice

In the previous research on discourse, the object of research has generally been discourse itself and its characteristics, the structures of various discourses, and the relationship of discourse to social structures. For example, traditionally, sociolinguistic studies, based on the speech community model proposed by Gumperz, have researched on the relation between discourse types and social structures. According to Gumperz (1986), the speech community is defined as follows:
To the extent that speakers share knowledge of the communicative constraints and options governing a significant numbers of social situations, they can be said to be members of the same *speech community.*

(p. 16)

Gumperz (1986) also pointed out that such shared knowledge depends on intensity of contact and on communication networks, such as countries, tribes, religions, or ethnic groupings (p. 16). Projects based on this model attempt to relate a certain discourse to a specific social group. Meanwhile, how a certain discourse is organizing a certain social relationship or activity has not been shed light on. In other words, in previous studies, discourse has not been studied as practice. Because of that, how one can access a certain discourse or obtain opportunities of interaction has not been studied except few studies such as Briggs (1983, 1984, 1986).

However, as I wrote in the introduction, for the purpose of NA of IGSs, the problem was one of not being able to have opportunity to interact with members of lab in Japanese, and not being able to access Japanese discourse. In order to grapple with these problems IGSs are confronted with, situated learning theory framework is more powerful...
than previous research frameworks dealing with discourse. In situated learning theory, discourse is also a form of practice and the problem of one’s access to a discourse can thus be considered an issue of each member’s access to a certain practice.

Therefore, I will next illustrate the perspective in viewing discourse as practice by reviewing the most relevant research. In doing so, I will explore a way of analyzing how access to discourse as practice is organized.

Discursive practice as organizing community

According to situated learning theory, various CoPs are not something out there. Rather, they are organized in people’s everyday practice. This perspective on CoPs can be found in Chicago school sociology, cultural studies, and ethnomethodology.

The object of these sociological studies is not discourse. However, what they analyze is exactly discursive practice. Although these studies have been conducted in the context of sociological research, they can be regarded as studies that show how discourse as practice is organized. Let me start by turning to the first example for organizing
A sociologist ethnographer of the Chicago school, Becker (1963) illuminates the

communities of dance musicians. The following is what one musician said about

“squares” who do not really understand what music is.

JOE: You’d get off the stand and walk down the aisle, somebody’d say, “Young
man, I like your orchestra very much.” Just because you played soft and the
tenorman doubled fiddle or something like that, the squares like it...

(p. 90)

In the next excerpt, Tom’s band was playing at an Italian wedding party for money,

not for “art”.

He said, “All right, let’s play the Beer Barrel Polka.” Tom said, “Oh shit! Here we
go.” We played it and then we played an Italian dance, the Tarentelle.

(p. 94)

In these quotes, the musicians are not just describing certain situations. Rather

than merely describing square people, the talk shown above organizes and maintains the
boundary between their musician community and the “square” community in the
musician’s day-by-day practice. Moreover, by talking in this way, they participate in a
musician community, becoming musicians and continuing to be musicians.

Organizing a community 2

The following study by Wieder (1974), from the early stages of
ethnomethodological work, also inquired into a similar issue but from a different
perspective. Wieder’s ethnography examined the codes of convict residents (drug abusers
on parole) in a halfway house (where they receive rehabilitative programs.)

When talking with residents, staff and I often had a relatively friendly line of
conversation terminated by a resident’s saying, “You know I won’t snitch.”
Hearing such an utterance functioned to re-crystallize the immediate interaction as
the present center of one’s experiential world. ‘You know I won’t snitch’,
multi-formulated the immediate environment, its surrounding social structures,
and the connections between this interaction and the surrounding social structures.
(p. 168)

Just like the musicians above, the drug users’ talk is not just describing certain
situations. In the above excerpt, the resident’s utterance “You know I won’t snitch”
primarily works as re-pronouncement or reminder of the social role relations of the staff and the residents, and the appropriate relations or categories of various kinds between members. That is, it formulates one particular situation in a certain way. The formulation did not simply remind Weider of the relationship between Wieder himself, the staff, and the residents. In addition, it shows that this kind of role relationship was consistently organized and maintained through utterances like “You know I won’t snitch.”

Thus, telling and using the code is a practice where the drug users make the boundary between communities visible, and organize their identity. Talking about categories like “residents” or “staff” shows that the categories serve as more than labels for groups, but can be seen as indexing one kind of interaction or a part of practice, which creates and maintains boundaries between “residents” and “staff”.

Organizing a community 3

Not only marijuana users, dance musicians, and drug abusers on parole, but also high school students organize their community and boundaries of communities in the
same way. The following is an excerpt from Paul Willis’s (1977) *Learning to labor*, and is part of the description of “good students” by students from the working class.

Will No, it means like ear’oles, do-gooders, hear no evil, see no evil (...) I think the hard knocks and that like reggae, d’you know what I mean, reggae and soul, they don’t listen to this freaky stuff, then the poufs, the nancies, they like … the Osmonds, y’know, Gary Glitter.

(p. 38)

This kind of talk by high school students of the working class is a part of a practice whereby they organize a boundary, or make it visible between their own community and the good students in school.

The examples above are sociological studies; however, they are good illustrations of the fact that talking about a certain thing is not just describing something but is a practice of organizing a community, a social organization, or identity. The studies above are the roots of “*Jocks & Burnouts*” by Penelope Eckert (1989). Chicago school ethnography, cultural studies, and Eckert’s study below are in turn the roots of situated learning theory.

Eckert (1989) studied two groups of students, Jocks and Burnouts in high school
in the U. S. Most of the Jocks are college-bound and school life is center of their lives. Burnouts, on the other hand, go on to become blue collar or pink collar workers; they reject their school and they orient themselves toward neighborhoods and local areas in their lives. Eckert analyzed in a concrete manner the social networks of the two, what they are, and how they are organized day-to-day.

The above sociological research demonstrates that a community is not something given; rather, it is created day-to-day, and participants make it visible and organize it. This perspective on community was followed by the concept of CoP in situated learning theory. Wenger (1990) described this heritage by saying, “…the communities of practice observed by Willis and Eckert in schools are certainly not defined by the institution or its divisional lines; some of them even find part of their identity in engaging in a practice that expands defiantly beyond institutional boundaries” (p. 146).

In addition, these studies can be regarded as research illustrating discourse as practice, although, they do not directly study discourse itself. In the following section, this point of view is clearly shown in the discourse studies based on situated learning.
Discourse as organizing interaction, community, and participation

As shown already, sociological studies related to organizing communities focus on how social organization is constructed, and do not focus on language. However, these cases show that discourse itself can be regarded as a practice. For example, Becker's case of dance musicians talking about square people is not just describing certain situations through talk. The speakers are achieving the following as well:

(a) They are organizing an in-group situation (or, as I will discuss later in Chapter 7, "organizing backstage.")
(b) This also is part of their practice of organizing and maintaining the boundary between their community and "square" people's community.
(c) At the same time, they are organizing and displaying their identity as dance musicians who are different from square people.

In other words, the talk here is embedded in the practice of dance musicians, but at the same time is a practice of organizing the situation and the community, i.e. a part of the practice. In the following section, research focused on this kind of discourse as
Recently, there have appeared a series of discourse studies influenced by Chicago school ethnography, Cultural Studies, Eckert’s study, and situated learning theory. These studies were conducted by Eckert & McConnell-Ginet (1999), and Bucholtz (1999). These researchers attempt to regard discourse as practice or part of practice. From their perspective, talk concerns the following points:

- Organizing the situation, interaction, or mutual relationship
- Organizing a community
- Organizing the participation in a situation, community, and activity
- Organizing identity through participation

Bucholtz calls this perspective the CoP model. This model can be regarded as an application of situated learning theory to discourse study. As previously described, the CoP model, community is not a “given” entity, but is something practically organized and maintained. From this perspective, “talking” is a practice, or a part of it. In other words, talking cannot be separated from a community, practice, participation, or organizing identity. Further, in the CoP model, discourse is regarded as part of practice, which organizes the community. Expanding the CoP model, it is possible to say language
learning cannot be separated from the participation in a situation or practice.

In her study on high school nerd girls, Bucholtz (1999) illustrates how they organize the nerd community through talking. According to Bucholtz, these nerd girls would talk, for example, about sesame seeds on bagels and sesame trees for extended periods. When they would run out of the knowledge, as a joke they started creating an anthropological story about how sesame seeds fall like rain and are collected in baskets on top of women’s heads. Through making this kind of trivial knowledge pursuit or even jokes into a Discovery Channel-like discourse, they display a kind of intelligence. In other words, they make themselves visible and organize themselves as nerds through mutual display of their intelligence.

The issue of access to discourse

As it was shown in the previous section, Bucholtz (1999) showed clearly, based on situated learning theory, the perspective of discourse as practice. However, she did not focus on the issue of how one could access the particular discourse. Nevertheless,
following situated learning theory, since discourse is a practice, how access or opportunities for interaction are organized are crucial issues to be studied.

In sum, by studying only the situations where language is used, issues such as how the opportunity for interaction is organized, or, how one becomes able to access a certain discourse, cannot be clarified. Further, the issues of access to discourse are crucial and realistic problems for IGSs as many of them voiced their difficulty of having problems of obtaining opportunities for interaction. Thus studying how one can have opportunities for interaction and how one can or cannot access a discourse are very critical in order to address IGSs’ real problems, even though such study does not directly study discourse itself. In the following, from this perspective of access toward practices, I will review studies concerning discursive practice.

Brigitte Jordan’s ethnographic study (1987) of a training program for traditional birth attendants (henceforth TBAs) in the Yucatan Peninsula well illuminates the point how a discourse as a specific practice is organized. Further, her research is relevant to the issue of access to discourses although she does not point it out explicitly.
According to Jordan, in most third world countries, the method taken for dissemination of health care was the improvement of the skill of the health care workers, including TBAs, at the village level. However, despite decades of efforts, the training program for TBAs had not been effective. In order to find the reason why it was not working well, Jordan conducted an ethnographic study of a training program for TBAs in the Yucatan Peninsula.

According to Jordan (1987), the first lecture of the training program was about family planning. Midwives attended the lecture style class in a lecture room of a hospital. Once the lecture started, a series of significant behaviors were observed. They sat impassively, gazed far away, feet dangling, obviously tuned out, in a “waiting-it-out” posture as in other waiting situations like waiting for a late bus. Some of them hardly understood Spanish, the language of the lecture. However, even with the Maya-Spanish interpreter, there was not much change. Contrary to the lecture situation, they actively participated in situations where they were actually allowed to do something.

Their lack of engagement in lectures was aggravated by the program’s preference
for teaching abstract principles, especially definitions. A nurse asked the rhetorical question “what is a family?” and started writing the definition “a family is a group of people who live under the same roof and have as a common goal the desire for a better life.” When the nurse started writing, most of the TBAs stared vacantly, and there was little response. The nurse urged them to copy the definition, but they responded with excuses such as that they had forgotten to bring a notebook, or did not have a pencil, or could not write.

The nurse gave them paper and pencil, walked around the desks, and in the end, staff members started to write the definition for them and hand it to the illiterate midwives. When Jordan asked a doctor why he was doing this, he replied that it was because the midwife could not write. When Jordan pointed out that the midwife also could not read, he responded that if she had that paper, someone would read it for her. The TBAs were told to memorize the definitions because they would appear in the final examination. Then the nurse continued with the next rhetorical question.

What kind of influence would this kind of memory task have on the work of?
midwives? This type of information via language was remembered as talk irrelevant to activities.

According to Jordan, this was not much different for lectures with visual materials because local way of interpreting pictorial representation was different, based on midwives' “visual literacy.” They were not used to the western method of enlarging and shrinking sizes or abstract line drawings without any background, change of color, or liner perspective. They have their own tradition of visual representation. Thus they could translate pictorial representations of their own iconographic system and map them with the real-world equivalents, but not with western pictures: “… they could not readily understand our peculiar convention, according to which an object that looks like a tennis ball on the screen represents something invisible to the naked eye, the ovum” (p. 8). Thus for them, line-drawn ovum was nothing more than a line picture on the screen.

According to Jordan (1987), in the midwives’ daily life, skills were acquired by observing and imitating. Talk had the role of convenience rather than being central. In the traditional system, midwives were used to learning experientially. They learned by “going
around" with experienced midwives and carefully monitoring the course and outcome of
the births. Talk was closely connected to and supported action. In the traditional Yucatan
system, to know means to know how, and derivatively, to know how to talk. For example,
one midwife was calling the uterus “prolapso”. This word probably came from the term
that appeared during the training course: prolapsed uterus. According to Jordan, the
knowledge acquired in the verbal mode (lectures in class) was not translated into other
behavior (their midwifery practice).

In sum, according to Jordan (1987), what the TBAs learned from this course was
new ways of talking, legitimizing themselves, presenting themselves as being in league
with this powerful system. Other than that, this course had very little impact on their
practice.

Traditional midwives in the Yucatan Peninsula owned their midwife discourse in
their work as midwives. Their discourse was tightly connected to their action as
midwives, and supported their action. On the other hand, the classroom discourse of the
training course was not accompanied with actual activities of midwives. Rather, it
involved only attending a lecture class and answering questions, that is, the actions of “becoming a student.” In other words, for midwives, classroom discourse was irrelevant to midwives’ work practice. Rather, such discourse was connected to the classroom practice of becoming students. Jordan interprets this discrepancy to show that learning discourse as a particular practice cannot be separated from the way of participation in a practice.

Jordan’s study above can be regarded as research on access to practices including discursive practice, although she does not explicitly discuss that issue. As Lave & Wenger (1991, p. 107) point out, the education program sponsored by UNESCO for Yucatec midwives is not enabling in a primary sense. There, midwives did not succeed in learning western practice of biomedicine, or midwifery; they only learned how to talk in an authoritative way.

Lave and Wenger (1990) pointed out this conclusion in the following way:

This is also Jordan’s conclusion about Yucatec midwives’ participation in biomedical, state-sponsored training courses. She argues that the verbal instruction provided by health officials has the effect of teaching midwives how to
talk in biomedical terms when required. Such talk only serves to give them “face-validity” in the eyes of others who believe in the authoritative character of biomedicine. But Jordan argues that it has no effect on their existing practice.

(Lave & Wenger, 1991, p. 107)

What should not be neglected is the fact that the midwives still could not access the practice of western midwifery or discourse in that practice. Thus, in this case, they were sequestered from real western practice and the discourse of midwives, as in the butcher’s case introduced by Lave & Wenger. The midwives were merely participating in western “classroom” discourse.

This does not necessarily mean classroom practice is useless. However, in western midwifery education, students not only participate in classroom practice, but also are provided with the opportunities to participate in real midwifery practice. In this case, participation in the classroom discourse complements the participation in the discourse of real midwifery practice. In sum, the issue of a way of access to a discourse can be regarded as the issue of access to practices.

Jordan’s UNESCO training program case is also related to the issue of participation in various situations. The midwives were not given opportunities to
participate in various situations, including the real practice of western midwifery.

Moreover, Jordan reports that the UNESCO staff did not understand the local traditional midwifery practice. The program could have promoted learning much more if the UNESCO staff had incorporated the local daily practice of traditional midwifery in addition to western medicine, for example by making active comparison as part of lectures.

Even if it was a didactic one-way lecture-based instruction such as UNESCO training program, if the opportunities to participate in western midwifery by observing, and assisting experts were provided, then, concepts and jargons they learned in class could have been used in the context of real practice. In sum, as I have shown in this chapter, it is very meaningful to study access even if it is not directly studying discourse itself.
2.5 Identity, position and intellectual capital

Learning and identity

According to Lave & Wenger (1991, p.47), traditional cognitive psychology regards learning as a process by which a learner internalizes knowledge, whether “discovered,” “transmitted” from others, or “experienced in interaction” with others.

On the other hand, learning concerns an issue of whole person from perspective of situated learning theory. Situated learning theory considers learning as increasing participation in a CoP. Lave & Wenger (1991) write about this as follows:

In contrast with learning as internalization, learning as increasing participation in communities of practice concerns the whole person acting in the world. Conceiving of learning in terms of participation focuses attention on ways in which it is an evolving, continuously renewed set of relations; this is, of course, consistent with a relational view, of persons, their actions, and the world, typical of a theory of social practice.
(p. 49-50)

From this standpoint, becoming able to accomplish a certain task, or acquiring new knowledge, is not limited to internalization of skills and knowledge. Rather, as Lave
& Wenger (1991) write below, it should be placed in a broader systems of relations, and it should be related to identity formation in these broader systems of relations.

In this view, learning only partly – and often incidentally – implies becoming able to be involved in new activities, to perform new tasks and functions, and understandings do not exist in isolation; they are part of broader systems of relations in which they have meaning. … The person is defined by as well as defines these relations. Learning thus implies becoming a different person with respect to the possibilities enabled by these systems of relations. To ignore this aspect of learning is to overlook the fact that learning involves the construction of identities.

(p. 53)

In the following, Lave & Wenger rephrase the same idea in a simpler and more concrete way.

… a deeper sense of the value of participation to the community and the learner lies in becoming part of the community. Thus, making a hat reasonably well is seen as evidence that an apprentice tailor is becoming “a masterful practitioner,” …

(p. 111)

Thus, from situated learning theory perspective, becoming able to do something does not simply mean acquiring a certain skill or knowledge. Rather, it means to become
"a full participant, a member, a kind of person" (Lave & Wenger, 1991, p. 53) in a CoP.

Therefore, "becoming able to do something" in a CoP cannot be separated from a way of participation, or occupying a certain position in a CoP. Moreover, occupying a certain position legitimated by a CoP, is related to how one forms one's identity. In other words, what one can do, or what one becomes able to do is rather a "whole person" issue (Lave & Wenger, 1991, p. 53) that includes change in form of participation and/or acquiring a certain position.

Lave & Wenger do not explicitly point it out but becoming a member or occupying a position in a CoP also seems to be related to the issue of access. For example, as I mentioned in the introduction, in a CoP, being able to access certain activities or resources indicates who one is, and what kind of position one occupies in that CoP as well.

In short, learning according to situated learning theory is something that can be indicated as a way of participation or obtaining a position, accessibility to activities and
resources, and a way of forming identity. Moreover, even if one possesses certain
knowledge or a skill, learning cannot be reduced to an individual’s ability. Rather, certain
knowledge or a skill can become valuable “socially.” This kind of socially valuable
knowledge or skill, can be called “intellectual capital,” borrowing the term of Bourdieu
(1977). As I will introduce in detail in Chapters 5 and 8, certain knowledge or skill could
become capital in a CoP. For example, in the lab I studied, a Japanese student who had
skill in using a lathe and mill machine to process metal, or an international student who
had English skill, could obtain a specific position and easily access certain resources and
activities because of these skills. How one’s intellectual capital is recognized by members
of a CoP is also related to how one forms his/her identity. Thus having knowledge or a
skill cannot be separated from a way of participation, identity formation and access to
resources and activities in a CoP.

**Participation in multiple CoPs and identity formation**

In Lave & Wenger(1991), the authors exclusively focus on one’s participation in a
specific CoP and identity formation there. On the contrary, Lemke (1997) points out that one participates in multiple communities rather than in one CoP. "Part of what it means to be a legitimate peripheral participant (LPP) in a community of practice … is that full membership in the community is the assumed consequence of increasing participation.” (p. 42) However, he points out that “any real community consists of many communities of practice, and every community member very likely participates in several of these …” In short, Lemke claims that we all participate in several CoPs, and a way of participating in a CoP is deeply related to a way of participation in another CoP.


Wenger (1990) introduces a case that is related to the nexus of several trajectories of participation in multiple CoPs (p. 164). Wenger illustrates the role of a broker in a youth peer community by citing Eckert (1989). According to Eckert, in a peer community of juveniles, a knowledge broker is a peripheral existence. However, because of this peripheral position, she has a potential of being an agent who brings about change in the
CoP. For example, by the leader and other members being interested in a new trend brought by this knowledge broker, this knowledge broker in the periphery will become empowered to move toward full participation. At the same time, the leader and the other members now move toward the position of the broker, which was previously a peripheral position. Then an individual such as knowledge broker could become an agent of change by bridging across CoPs.

This example illustrates that one’s obtaining a certain position (a knowledge broker, in this case) is not by participating in a certain CoP, but by participating in several CoPs. The formation of the identity as a knowledge broker cannot be separated from the participation in the several CoPs. Further, Wenger (1998) formulates identity as something formed through reconciliation in participating in various CoPs. (pp. 158-161). Thus, Wenger attempts to relate one’s multiple participation in several CoPs to identity formation.
• Identity formation as discovering and creating a unique self in a CoP

The case of the knowledge broker that Wenger referred to shows that there are various ways of participation in a CoP, and participation cannot be discussed in terms of linearity. For example, a position such as a knowledge broker cannot be reduced to the dimension or degree of participation in a CoP. Rather, it is a very specific and unique position derived from participation in multiple CoPs. Here, the term “position” means something beyond the degree of participation in a CoP. It indicates various and unique ways of participation in a CoP that cannot be plotted in a linear path from peripheral to full participation.

However, Wenger’s formulation of participation still maintains directionality and linearity of participation in a CoP such as from a novice to master, from a newcomer to old-timer, or from peripheral to full. Wenger (1998) denies the linearity in the following excerpt. “As we go through a succession of forms of participation, our identities form trajectories, both within and across communities of practice. …because it is constructed in social contexts, the temporality of identity is more complex than a linear notion of
time” (p. 154). Nevertheless, on the same page, he introduces “peripheral trajectories” by saying “By choice or by necessity, some trajectories never lead to full participation” (p. 154). This leaves readers with strong impression of linearity.

As an example, Wenger still interprets the case of the knowledge broker as a case of increasing participation in a peer group.

Wenger’s argument seems to be missing an important point. If one views identity formation as reconciliation of participation in various CoPs, the following point of identity formation will become lost: identity formation includes discovering or nurturing a unique self in a CoP through one’s participating in various CoPs. I will discuss this point in detail in Chapter 8.

2.6 Design for pedagogy and design for learning environment

As introduced in Chapter 1, Lave & Wenger (1991, p. 97) make a distinction between two perspectives on curriculum: a learning curriculum and a teaching curriculum. From the perspective of learning curriculum, curriculum consists of situated opportunities
(thus including exemplars of various sorts often thought of as "goals") for the
improvisational development of a new practice. According to Lave & Wenger, "A
learning curriculum is a field of learning resources in everyday practice viewed from the
perspective of learners" (1991, p. 97). On the other hand, a teaching curriculum consists
of items which are supplied by the teaching side in the form of prescriptions about proper
practice. It is constructed for the instruction of newcomers. The meaning of what is
learned is mediated through an instructor's participation, by an external view of what
knowing is about.

If one follows this distinction between a learning curriculum and a teaching
curriculum, as proposed by Lave & Wenger, the view of what should be prepared for
learners would naturally be different between these two. That is, from a teaching
curriculum perspective, the method of instruction for learners has to be designed. This
design of instruction method is based on a cognitive psychological model of learning.
From this perspective, the design of an instructional method means to develop a series of
treatments for improving skills and competence of a learner as an individual.
On the other hand, for a learning curriculum, design for learning environment is what is necessary. As Wenger (1998) says, “The first requirement of educational design is to offer opportunities for engagement” (p. 271). This design of learning environment is based on situated learning theory, and it means designing support resources, social organization and opportunities for participation in a CoP, and access to various activities, occasions, and artifacts in practice (Wenger, 1998, pp. 263-277). I will provide examples to illustrate this point in a more concrete manner.

As an example of design for learning environment, the most materialistic one is design of space. For example, for tailors in Liberia all the process was visible because the work was done in open space (Lave & Wenger, 1991). In this open space, apprentices could observe the different and/or more advanced work processes that were not their own work. Thus in the tailor shop, the process of making garments was designed in such a way that apprentices were able to access the practice. On the other hand, newcomer butchers in a supermarket were assigned to engage only in meat wrapping in a sequestered room. Therefore, unlike tailor shop apprentices, newcomer butchers could
not observe old-timers engaging in skilled work. Thus, newcomers could not access meat
processing practice. In this case, thus the physical walls of the room, the closed space,
prevented apprentices from accessing the practice.

However, the design of space, in the cases above, was not designed out of context,
independent of the environment. Rather, it was closely related to the organization of
division of labor for production. Thus in situated learning theory, the design of social
organization for practice is accompanied with the design of the learning environment.

Hutchins introduces a relevant case regarding the design for learning environment.
He describes how the navigation of a large vessel is done, and by what kind of social
organization and artifacts (Hutchins, 1990). For example, in order to locate the vessel, it
requires such processes as bearing taking, bearing time-recording; plotting Team
members of the navigation team are assigned to be a bearing taker, a bearing
time-recorder, and a plotter (p. 17), depending on their experience.

Hutchins explains about knowledge in cooperative tasks as it is “frequently
assumed by analysis to be partitioned among individuals in an exhaustive and mutually
exclusive manner such that the sum of the individuals’ knowledge is equal to the total required, and there is little or no overlap” (p. 17). According to Hutchins, the work was not separated neatly according to members’ roles; rather, there were substantial overlaps among their work. It is called “redundancy of function.” This in turn provided opportunities to observe each other’s work. For example, a more experienced bearing time-recorder could help a bearing taker. Meanwhile, the least experienced bearing taker could prepare for his future by observing bearing time-recorder’s work. This kind of organizing of overlapping, redundant division of labor consisting of human and artifacts provides members with learning opportunities while making the navigation system robust.

This example of Hutchins’ illustrates how the design for learning environment, which guarantees mutual access, is embedded in ways of organization of the division of labor.

Another example is the case reported by Wenger (1990). According to Wenger, newcomers in an insurance company left their jobs shortly after the training period. After
they finished their training and moved on to the floor (the actual job), they lost their informal network that they had created during the training period, because they were placed in different divisions. Moreover, old-timers were too busy to support them, so that newcomers became isolated on the floor. This problematic situation could likely be improved by creating a system that would enable the maintenance of the network formed in the training program even after the newcomers were placed on the floor, or a system where old-timers could support newcomers. Actually Wenger himself proposes a buddy system of old-timers to collaborate with newcomers (Wenger 1990, p. 184). Such an approach would be expected to better facilitate the newcomers’ entry into the CoP. What Wenger proposed for the insurance company can be regarded exactly as a design for learning environment. On the other hand, the perspective of design of instruction proposes more narrowly how to refine instruction methods in a training course.

What should be designed for learners based on needs analysis will also differ between the two perspectives on learning. The perspective of design of learning environment attempts to develop ways to support learners to organize resources,
networking, and collaboration. On the other hand, the perspective of design of
instructional method attempts to elaborate methods to facilitate students’ acquisition of
knowledge and skill.

In order to view IGSs’ needs from a larger perspective, the perspective of design
of learning environment based on this situated learning theory will provide a new
framework. The question then arises concerning how learner needs can be specified from
this situated learning theory perspective.

2.7 Controversy over situated learning theory

There have been criticisms voiced about situated learning theory. I will review
both major and typical criticisms, and will summarize what kind of discussion is
constructive in order to develop situated learning theory.

Criticism from cognitive psychology

The most well-known criticism to situated learning theory is the one by Anderson,
Reuder & Simon (1996). According to them, situated learning theory claims that “transfer”
does not occur. However, they say that experimental research presents empirical evidence against situated learning theory advocates’ claims.

The following is a typical transfer experiment cited in Anderson, Reder & Simon (1996).

In one famous series of studies (Gick & Holyoak, 1980, 1983), subjects were presented with Duncker’s (1945) classic radiation problems: “Suppose you are a doctor faced with a patient who has an inoperable stomach tumor. You have at your disposal rays that can destroy human tissue when directed with sufficient intensity. How can you use these rays to destroy the tumor without destroying the surrounding healthy tissue?” (adapted from Gick & Holyoak, 1983). Prior to their exposure to the target problem, subjects read a story about an analogous military problem and its solution. In the story, a general wishes to capture an enemy fortress. Radiating outward from the fortress are many roads, each mined in such a way that the passing of any large force will cause an explosion. This precludes a full-scale direct attack. The general’s plan is to divide his army, send a small group down each road, and converge on the fortress. The common strategy in both problems is to divide the force, attack from different side, and converge of the target. After reading this story, however, only about 30% of the subjects could solve the radiation problems, which is only a “limited” improvement (although an improvement by a factor of three) over the 10% baseline solution rate (Gick & Holyoak, 1980).

(Anderson, Reder & Simon, 1996, p.7)

When a subject uses the idea of applying several rays of weaker intensity from
different directions directed to the tumor, it is considered as successful transfer. Anderson et al.'s (1996) conclusion about transfer are, first, depending on the situation and the relations between original material (such as reading material above) and target material, the amount of transfer varies, sometimes having a negative effect. Second, the mode of representation and degree of practice are major determinants. Also domain difference, and the number of symbolic components shared are directly related to transfer. Third, the direction of subject's attention is also an important factor. Thus the training on cues which signal the shared characteristics likely to assist transfer. (Anderson, Reder & Simon, 1996, p.7-8)

These kinds of arguments about transfer by Anderson et al. (1996) presuppose a dichotomy between general knowledge, which is transferable to various contexts, vs. specific knowledge. From a cognitive psychological point of view, situated learning theory is seen as claiming that knowledge is context dependent. The claim of Anderson et al. is based on empirical evidence that shows that knowledge and skill is dependent on contexts.
There is a counter-argument toward Anderson et al. because their position against situated learning theory is based on misunderstanding. For example, Ueno (2001) argues about this assumption of Anderson et al. (1996).

According to Ueno, the argument of Anderson et al. (1996) does not question the theoretical presuppositions of conventional cognitive psychology. They attempt to answer this issue based on their theoretical presuppositions. From the approach of situated learning theory, each camp has different theoretical presuppositions for example, the meanings of terms such as context and knowledge are quite different between the two camps. Furthermore, situated learning theory does not presuppose dichotomy of context free knowledge and context bound knowledge, while cognitive psychologists presuppose this dichotomy.

From situated learning theory perspective, first of all, whether “transfer” exists or not is not an issue at all. Rather, the issues are: what kind of context is organized, whether this context is visible (or not visible) to the participants, and how this phenomena, something called “transfer” is locally and collaboratively accomplished by an experimenter and subject through organizing resources. … It is also possible to say that many transfer experiments were merely examining conditional differences of how skillfully context markers were hidden or exhibited.
in that particular context. Moreover, the “generalization” which connects these
two stories is meaningful only in the context of the experimental room.
(Ueno, 2001, p. 2-3)

If one attempt to solve the radiation problem mentioned earlier in real medical
situation, to adapt the tactics of war story without considering various real conditions
seems like extreme simplification of the problem. For example, even though radiation
rays are distributed, these rays might destroy the surrounding healthy tissue of tumor
depending on cases such as child patient.

Thus he concludes that this “general knowledge” transferred by this experiment
is ironically “context dependent knowledge,” in reality only usable in the experimental
room (Ueno, 2001, p. 3).

As Ueno points out, criticism toward situated learning theory by Anderson et al.
(1996) is based on apparent misunderstanding. For example, advocates of situated
learning theory are not claiming that “knowledge is domain specific and does not
transfer.” Rather, they advocate that even when focusing on knowledge, one should
always pay attention to practice.
For example, general and abstract knowledge investigated in transfer experiments need to be related to specific practice when interpreted. In reality, as Ueno points out, applying a war strategy idea to a medical treatment cannot not be that simple. Resources and networks available in a war and medical setting are very different. When one engages in this kind of practice, there is a need for various conditions and constraints, and solving these problems are very likely to be done collaboratively.

In sum, an experimenter and subjects in an experiment are engaged in peculiar discursive practice and they organize unique interaction. For example, what an experimenter seeks is not a realistic solution. The correct answer is the specific “general and/or abstract knowledge” that the experimenter thought of for the purpose of proving a certain theoretical point. The task is not to solve a real medical or war strategic problem, but is to find the answer the experimenter thought of from skillfully hidden hints. Thus when both an experimenter and a subject successfully share the understanding of what kind of problem is meant to be solved, then it is perceived as successful transfer.

As we have seen, what situated learning theory claims is not that “transfer does
not occur," but rather that knowledge should always be understood in relation to practice.

From situated learning theory perspective, cognitive psychology experiments are also one particular discursive practice and transfer experiments should also be analyzed as such.

A similar point has been made by Street (1984). Street criticized the "great divide" theory (Ong, 1982, for example): if one is literate, one can be free from local contexts and can think in the abstract, whereas if one cannot read, she can only think in context-dependent manner. He argues that artifacts such as various documents, and ways to read and write these documents are embedded in terms of a practice, and social organization. In sum, what situated learning theory advocates is not whether abstract knowledge or thinking exists or not. Rather, it claims any knowledge should be studied in relation with practices where knowledge is utilized. Cognitive psychology does not have the concept of "practice". Thus, cognitive psychologists such as Anderson, et al. apparently understand the perspective of situated learning theory confined to their own theoretical framework.
Other criticism of situated learning theory and CoP

The criticism by Anderson et al. (1996) is based on misunderstanding and it cannot be said to have nurtured productive discussion. The discussion about knowledge in situated learning theory was a reappraisal of assumptions in conventional cognitive psychology. However, the criticism of situated learning theory by Anderson et al. is merely based on those assumptions. Lemke’s (1997) and Walkerdine’s (1997) criticism on the other hand, seem to include positive suggestions toward situated learning theory.

Lemke’s (1997) ideas were already introduced in the section on “2.5 Identity, position and capital”. Here I will examine Lemke’s argument in more detail. First, Lemke points out that there are various roles in many CoPs, rather than a linear role transition from newcomer to old-timer:

In the simplest case, we might imagine, a small homogeneous community of practice differs from member to member only in the degree of mastery of particular practices. Newcomers can aspire to oldtimer status, the oldtimers welcome their increasing participation, and the newcomers become oldtimers in their turn. If a community of practice (CoP) is defined in relation to its practices, so that any real community consists of many communities of practice, and every community member very likely participates in several of these, then for some
CoPs, the simplest model will be valid. But many CoPs are not like this. For one thing, many have hierarchically differentiated roles where there is no expected upward mobility for occupants. Teachers do not expect their students to become teachers with increasing participation in the classroom community. Do teachers and students then belong to different communities of practice? Not if the practice is defined in terms of activities in which both roles must be filled.

(pp. 42-43)

In the above excerpt, Lemke points out that in discussing participation in a CoP, situated learning theory has been focusing on the degree of participation such as from a newcomer to old-timer, and from peripheral to full participation. Moreover, Lemke (1997) points out that these various roles derive from participation in various CoPs.

What if mastery of a practice is not to be had solely by participating in that practice? Then increasing participation in a particular CoP will never be enough by itself to achieve full membership. It may be that one must also participate in some other CoP or engage in some other practices in order to master or be counted as having mastered the practices of the first CoP. This, too, often happens in real communities, where participation in a ritual (even if allowed) by noninitiates never in itself reveals to them the keys to esoteric meanings, which alone could enable them to be full participants. That can be had only by participating in some other activities, some other practices (initiation rites), perhaps even in a different community, certainly in a different CoP. It is not enough to hang around with lawyers or doctors or scientists, to assist them, to learn to speak part of their lingo, even to become very good at some of their visible practices to begin to be counted as one of them.
Lemke’s argument, which relates participation in various CoPs and various roles in a particular CoPs, offers a new perspective in situated learning theory. In this study, I will develop these arguments further in Chapter 8.

Meanwhile, Walkerdine (1997) criticizes the formulation of individuality in situated learning theory.

The relation of these discursive practices to ‘the real’ and ‘material’ is therefore quite complex. It is here that I part company with Lave’s formulation of practices. For Lave, practices were activities and people acting in a setting, specified by a dialectical relationship. I do not think that this is at all clear and carries the danger that neither the person nor the setting is theorized. Thus, we are left rather too close to traditional individual-society dualism than I presume that Lave would like.

Based on Foucault’s (1975) argument of constitution of modern individuality, Walkerdine criticizes situated learning theory, in that it does not analyze how “individuality”, which we take granted for, is produced.

As pointed out by Walkerdine, individual-society dualism cannot be overcome by
merely conceptualizing “people acting in a setting” like Lave. It is necessary to analyze how individuals are produced and in what setting, rather than “treating individuals acting in a setting”, where individuals are a given.

According to Foucault (1975), ever since institutions systematically started recording personal information in such places as schools and hospitals in 18th century, individuals became visible. On the one hand, the characteristics of the “mass” became visible by the average of population and distribution based on these records. On the other hand, by comparing individual entries with the average and distribution, “individuals” became visible as deviation from the average or distribution. Thus it became possible to control and educate certain “individuals” who became visible by these methods.

Individuality is also constituted in discursive practice. For example, Hood, McDermott & Cole (1980) analyze how an individual’s ability is focused on and made visible in classroom interaction. As Walkerdine points out, constitution of individuality in this kind of meaning has not been addressed in situated learning theory.

I will discuss how the framework of situated leaning theory can respond to
Walkerdine’s criticism in Chapter 8.

2.8 Summary

The purpose of this research is, as previously stated, to explore IGSs’ needs by focusing on their daily practice and participation in a CoP. In this chapter, I have examined situated learning theory while reviewing relevant research in detail for the purpose of exploring IGSs’ needs. Moreover, while scrutinizing theoretical issues, I will propose several perspectives in order to explore IGSs’ needs. I will summarize what I clarified below.

First of all, I showed that it is possible to clarify IGSs’ ways of participation by focusing on access to artifacts used in various activities and situations in IGSs’ practices.

Second, I showed that it is important to focus on ways of accessing discourse, before studying discourse itself. This is because, according to situated learning theory, discourse can be regarded as a practice or part of practice. Thus exactly as in the cases of other practices, how access to discourse is organized could also be an important research
agenda item. In fact, for IGSs, being able to access practice and gaining opportunities for learning language are inseparable.

Third, I showed that participation in a CoP cannot be formulated simply as increasing degree of participation as, for example, from newcomer to old-timer, or from peripheral to full participation. Rather, ways of participation in a CoP could vary. These various ways of participation could be manifested as various positions in a CoP. Moreover, as a backdrop of these various positions, there is participation in not just one CoP but in various CoPs.

This new perspective in situated learning theory could offer an efficacious perspective for analyzing ways of participation of IGSs who bring various CoP backgrounds to a university science lab. At the same time, data from my fieldwork provide this new theoretical perspective to situated learning theory.

What is possible for many IGSs in a lab is not being able to speak Japanese and participate in a lab practice in the same way as Japanese members. Instead, by utilizing their uniqueness as IGSs, they can participate by gaining a position in a CoP. If one
consider IGSs’ participation in a CoP as something varies as such, their needs could be considered not as something related to language only, but rather, something more broad such as gaining a unique position and participating in a CoP.

In order to respond to IGSs’ needs, one can use a perspective of design for learning environment originated from situated learning theory. Following this perspective, in order to respond to needs for IGSs, how to design activities, opportunities and social organizations which support IGSs’ access to practices will become the issue. In concrete terms, what kind of activities, opportunities and social organizations should be designed will become clear by exploring their needs in their daily practice and ways of participation to a CoP.
THE DEFINITION OF NEEDS

The purpose of this research is to explore IGSs’ needs by applying situated learning theory to an examination of IGSs’ ways of participation in a CoP. In this chapter, I will review how needs have been defined in SLA/JSL and in what situations it has been researched. By reviewing existing NA research, I will reconsider the meaning of “needs” and show what the contribution of my research is for the research on needs analysis of SLA/JSL.

There is a variety of meanings for “needs” in the SLA literature, as will be illustrated in this chapter. Thus it seems impossible to define needs in general, since the definition varies depending on the researcher’s point of view and the situation in focus in the research. This variation of meanings for needs in the previous research can be summarized in the following three dimensions.

1. From whose point of view are the needs decided—e.g. students themselves, instructors, curriculum designers, administrators, and/or other stakeholders?
2. What kinds of situations and activities are focused on in order to determine needs—e.g. classroom, daily life, work, and/or the lab?

3. Which domains and how much range should be considered—e.g. should the needs be limited to linguistic needs or something broader than that?

In the following, I will first summarize how needs have been understood by reviewing relevant studies along with the three dimensions. Secondly, I will characterize the needs of the IGSs focused on in this research. The needs of IGSs in this research extend beyond the linguistic domain and can best be captured in lab practice from the IGSs' perspective.

3.1 Needs from whose point of view

In this section, I will review the previous research by focusing on from whose point of view needs are identified. Benesch (1996, p. 276) has pointed out that each academic context presents a different set of hierarchical (in terms of the power and status of the stakeholders) and sometimes contradictory needs, including governmental,
institutional, departmental, and classroom ones, complicating the development of language for academic purposes curricula. In the case of international graduate students studying in Japan, where various stakeholders are involved in the enterprise of inviting and supporting the students, stakeholders’ perceptions of learner needs and of their own needs in relation to this enterprise are likely to vary as well.

Yoneda’s (1999) extensive questionnaire study of 118 faculty members concerning their perceptions of IGSs’ actual and ideal language use in research activities is especially pertinent to an understanding of the ways in which needs vary depending on the perspective taken. She found that the contact hours between IGSs and faculty members vary from less than two to 41-50 hours per week. A clear tendency is that research assistants spend more hours with IGSs than associate professors and lecturers, and professors spend even less time (65% of the professors spend less than two hours, followed by 16% at 3-4 hours, 15% at 5-6 hours). Professors are more favorable toward the use of English than research assistants, who tend to demand that IGSs use Japanese. Thus a professor with responsibility and power, quite possibly with the experience of
studying abroad and the ability to use English, may have a quite different opinion about what IGSs really need than research assistants who spend much more time with IGSs on a day-to-day basis.

Regarding IGSs in Japan, Sawyer and Mito (1998) discovered a language choice discrepancy among faculty members and students in interviews with advisors and their graduate students, both Japanese and non-Japanese (NNS of English). In one of the cases, the advisor said that it is not necessary for an IGS to learn Japanese, because publishing or presenting in Japanese does not have academic value, and the IGS should be studying English instead. However, this IGS's sempai (a senior student and in actuality his mentor) said that he should be able to speak Japanese in order to be a full-fledged member of the lab community. The IGS himself agreed with this view, citing the fact that he often receives help from Japanese students and the advisor is usually not accessible to the students.

According to Long (2000) and Norton (2000), even within the same individual, over a period of time, a learner's idea of what comprises his/her needs changes. Thus to
treat needs as some static and stable seems futile. A fieldwork-based study by Jasso-Aguilar (1999) exposed the complicated picture of language needs in a workplace.

She entered a hotel in Waikiki in the role of a new maid and followed experienced maids. As her research method, she employed participant observations (five 8-hour-observations in 5 months), unstructured interviews, and questionnaires. She interviewed a human resources person, an executive housekeeper, housekeepers, and supervisors, a task force group for improving service by NNSs. She also examined morning/afternoon briefings, documents such as job and routine descriptions, and the curriculum designed by the task force. By having a variety of sources of data and methods, she found out the discrepancies in perceived needs between actual housekeepers (Filipino, Chinese, Korean, and Vietnamese women, NNS of English) and the administrative side of the hotel (nationality and L1 are not clearly mentioned but most likely to be NS of English).

Additionally, for further insight, she documented her own experiences as a maid.

For example, in the training she found that there was little expressed that could not be seen and the speech included many demonstratives such as “this”, “that”, “go like
this”, and “put like this,” rather than complicated verbal explanation. Another scenario of discrepancy was guests without room keys asking to be let into their rooms. There was a model for such exchanges drafted by the task force assuming that the guest is an adult. This included the guest arguing and the housekeeper calling security. However, the two cases Jasso-Aguilar encountered with another maid both involved children asking for this favor. In one case, the housekeeper dealt with the case without using language. In Jasso-Aguilar’s conclusion, she argued for use of multiple sources and ethnographic research methods, so that one can determine the tasks and implement “a curriculum that will truly engage them in language learning …” (p. 45).

Jasso-Aguilar’s study on English for specific purpose (for hotel maids) clearly shows discrepancies in the perception of needs depending whose perspective is taken. However, the issue is not only seeing needs from whose perspective but also defining needs support from whose perspective. How defining needs support is depending on the theoretical perspective of learning. I will discuss this point further in section 3.4 in connection with looking at practice and design for learning environment.
3.2 What kind of situation and activity should be focused on?

Another workplace study, Long’s (2000) study on flight attendants shows how the perceptions of needs change according to sources of data, such as informants. Choosing something as the source for NA constrains what situations or activities will be focused on.

In Long’s research, when applied linguists (graduate students in applied linguistics who were also frequent flyers) described the job of a flight attendant, their focus and perspective were narrow, centering around the duties of flight attendants that were visible to passengers during the flight, such as food and beverage services, personal communication with passengers, and general in-flight announcements. The flight attendants themselves saw the top priority of their job as maintaining the safety of the passengers. Their description of their work covered not only time spent in flight, but also time spent on the plane before and after passengers boarded the flight, notably communication with other flight attendants and the cockpit, as well as with other
personnel such as managers, caterers, gate agents, schedulers, etc. This contrast illustrates well how needs appear differently according to different activities or situations focused on.

On the other hand, as will be elaborated later, most needs analyses for IGSs in Japan have focused on academic language needs in merely classroom situations. The exceptional cases are research reported by Murphy-Shigematsu (2000), Yoneda (1999), and Kanoo (1998). Each attempted to focus on activities such as informal chatting in labs with lab mates, and obtaining necessary authorization for various research-related activities in labs.

3.3 The range of needs

There are several perspectives concerning the range of learner needs in SLA. One is the traditional view of perceiving needs as linguistic knowledge such as grammar and vocabulary. Another one is a relatively new view to perceive needs as something broader, including the degree of access to institutional and cultural resources. In addition, there is
a view perceiving language needs as broader than those that can be expressed linguistically, such as grammar and vocabulary items, and inseparable from participation in practices (Murphy-Shigematsu, 2000; Norton, 2000; Narita, 1998; Sawyer and Mito, 1998; Peirce, 1995; Arikawa, 1993). In the following section, how the range of needs has been perceived in existing research will be reviewed.

Focus on formal academic language needs

As pointed out by Ootsubo (2001), the bulk of existing JASP studies have focused narrowly on linguistic needs. They can be classified into two basic categories. The first type is text analysis based on linguistic corpora, and includes studies of specific vocabulary or specific structures used in a particular discipline, such as those by Unedaya (2003); Yoneda & Hayashi (2003); Komiya (2001, 1995); Fukao & Baba (2000); Muraoka (1997, 1999, 2001); Muraoka, Chinami, Nishina, Fukao, & Kanoo (2001); Muraoka, Kagehiro & Yanagi (1997); Gomi (1996); Murata (1996); and Oono, Itane, & Shinagawa (1994). Fukao & Baba (2000), for example, chose the -nitaishite (about,
toward, etc.) pattern and analyzed its use in 60 Agriculture and Engineering journal articles, with the ultimate purpose of improving writing education.

The second type of study has tried to identify the relative importance of the traditional four language skills, or various language functions, or to what extent particular sub-skills are important for particular target learners. These studies have been conducted mostly using a questionnaire format, and include those by Shimada & Shibukawa (1999); Yamashita (1999); Fukushima, Uehara, & Sukekawa (1997); Sato & Nishina (1994); and Oono, Itane, & Shinagawa (1994). As an example of this category, Oono et al. (1994) asked 73 international students (ISs) to fill out questionnaires on pre-chosen categories of situations and functions for which they perceived ISs most needed Japanese.

Although it is not a NA of Japanese learners, Narita (1998) studied the academic language needs of international graduate students in the U.S. For nine months, she studied three students: an Indian Ph.D. student, majoring in Mechanical Engineering, a Japanese MA student majoring in Japanese language, and a Korean MBA student (she also taught these participants prior to the formal data collection). For the first five months,
she interviewed the participants once every other week and e-mailed them regularly.

Then she conducted a non-participant observation of content classes of their majors for several weeks during three-month period (approximately 10 hours observation per class).

Three of the content class professors were interviewed for their opinions about what they think the “necessary” academic skills were. In her conclusion, Narita pointed out the importance of learners’ meta-cognitive awareness, strategic use of flexible mushfaking\(^2\) skills, and the support of peers. She suggests that instructors introduce these strategies and their value as learning tools. Narita’s (1998) study can be regarded as one of formal academic language needs. However, it does not merely focus on language needs, but rather expands to metacognitive needs in language use.

\(^2\) Mushfake Discourse is a phenomena mentioned by Gee (1998). Narita’s participants demonstrated “great resourcefulness in employing various strategies that compensate for their lack of mastery” (p. 27). Mushfake Discourse “often occurs when an individual encounters a new discourse ‘late in the game,’ and is unable to acquire it perfectly. Even without mastery, the novice may still find a way to succeed, employing “partial acquisition coupled with meta-knowledge and strategies to ‘make do’” (Gee, 1996, p. 147).
Japanese as “the” academic language

Running through the above studies is the implicit understanding that the academic language for formal reading and writing by IGSs in Japan is Japanese, and that the goal of Japanese language training for this population is the attainment of native-like linguistic proficiency. Scholars such as Fukao (1999, 2001), Kanoo (2001), Murata (1999), Yamashita (1999), and Muraoka (1999) have gone further to state these goals explicitly. For example, Murata’s (1999) study on the association of certain sentence patterns with certain academic genres starts with the explicit assumption that for most learners of Japanese whose general goal is to study and conduct research in their respective fields, a concomitant goal is to write academic papers in Japanese (p. 32).

However, despite the common assumption voiced above, some researchers have become aware that IGSs’ academic language is not necessarily Japanese (Fukushima, 2003; Murphy-Shigematsu, 2000; Nishina, 1999; Yoneda, 1999; Sawyer & Mito, 1998; Takeyama, 1996). Referring back to her 1990 study, Nishina (1999) points out several interesting facets of IGSs’ language use. First, the language of academic reading and
writing for IGSs is often English. Second, despite this, Japanese is generally the language of communication in labs. She also points out that most IGSs are NNSs of English as well as of Japanese, and that the IGSs who stay in Japan for extended periods continue to take Japanese classes hoping to fill the gap between their current Japanese ability and the ability necessary for effective interaction in daily lab life. Science faculty, too, have recognized English, or both Japanese and English, as the academic language of IGSs (Yoneda, 1999; Sawyer & Mito, 1998; Takeyama, 1996). Thus, reports have appeared in the research literature suggesting ambiguity in the medium of academic work between Japanese and English in Japan, but since they have not been systematically collected or analyzed, it is not yet clear to what extent and in which contexts Japanese and English are preferred or required, and what factors determine the choice.

The language of daily interaction

Since all Language for Specific Purposes (LSP) programs are designed for very short term courses, and since reading and writing are the most salient academic skills in
most formal academic contexts, face-to-face communication is often neglected in LSP programs. This is a real problem in the case of IGSs, because their academic success is tied to at least some amount of effective communication in their labs. The contention of Japanese being the language of communication in labs is supported by Sawyer & Mito (1998), Murphy-Shigematsu (2000), Yoneda (1999), Muraoka (1997), and also Kanoo (1998), who expands the category of Japanese needs in an academic setting by including informal chatting in labs with lab mates, and obtaining necessary authorization for various research related activities in labs.

The medium of lab communication being the dual use of not only Japanese but also English has also been reported (Yoneda, 1999; Sawyer & Mito, 1998; Kanoo, 1998), but the extent and functions of use of each of the two languages have not been clearly documented or discussed, possibly because Japanese language teachers, who are the overwhelming majority of researchers in this area, tend to exclude English from their research scope.

Thus far, the studies focusing on the linguistic needs of international students
have been reviewed. However, there are a few studies viewing learner needs from a broader perspective.

Based on his role as international student counselor, Murphy-Shigematsu (2000) was in a good position to hear what IGs were most dissatisfied with. He summarizes three specific problems that they most often encounter: (1) inadequate/inaccurate information on language and degree requirements; (2) shortcomings in academic programs and faculty guidance; and (3) differences in values. Language and communication issues are reported as severe problems, as reflected in the following quotes: “My advisor told me I could study in English. But the chemicals are all labeled in Japanese, the other people in the lab speak only Japanese, and the seminars are all in Japanese. When I do my presentation in English, no one asks any questions” (p. 106). Additional very illustrative quotes were “Japanese are not honest. They don’t communicate directly. Everything is said privately, behind your back. Sometimes everyone knows but you. Why can’t they just speak directly?” (p. 115). “My professor expects me to be there in the lab all times. Why? Just because everyone else is there?
That is so stupid. I work better at home. Seminars? When I found out they are in Japanese, I told him I don’t want to come, because I can’t understand what is being said.

He said, ‘come anyway.’ Why? ‘Because everyone should attend. That’s all’” (p. 116).

Whereas Murphy-Shigematsu (2000) pointed out a number of similarities in the kinds of communication gaps suffered by IGSs in Japan, Hirao (1999), in her paper about the curriculum of Osaka University of Foreign Studies, focuses on two of the variables that are integral to understanding the needs of very similar ISs: academic status (undergraduate or graduate); and varying degree of Japanese skills required according to their specialty. Other distinctions not noted by Hirao but which still seem very important are the differences of rikei (hard science majors) vs. bunkei (non-hard science majors) practices, pre-existing kanji literacy or lack thereof, and Asian vs. non-Asian physical appearance.

Although not intended to be used as a NA, Arikawa’s (1993) ethnographic study of Indonesian IGSs in Japan clearly implies needs of IGSs beyond those of language.

Arikawa studied Indonesian government employees who had received scholarships from
the Japanese or Indonesian governments to study in Japanese universities for 3 years. She
used an earlier version of CoP (Lave & Wenger, 1991) as part of her theoretical
framework in her study, and she illustrated the process of the students gaining more
knowledge about university life through participation in activities. However, they did not
"blindly pursue mastering Japanese practices" because their understandings and goals
were not exactly the same as those of the Japanese. "Indonesian students constructed their
test knowledge about cultural conventions based on their Indonesian experiences and
attempted to create an Indonesian style of life in Japan" (p.192). One example is their
practice of cooking all their own meals because there was no restaurant which served
halal (appropriately processed food meeting strict standards of Islamic code) meat.

The objective of Arikawa's study was not to specify IGSs needs, but this sort of
ethnographic research nevertheless reveals what kind of needs exist beyond linguistic
needs.

A study conducted by Norton (2000; Peirce, 1995) was also not an explicitly NA study, but still has a strong implication for reconsidering language needs as something
much broader than purely linguistic ones, though in a different sense from Arikawa’s study. In her study, Norton sheds light on how immigrant women in Canada gained opportunities to speak English, by focusing on her five participants’ living situations outside the classroom, as revealed in their interviews and their diary entries.

She illustrates that gaining opportunities to speak English is inseparable from gaining certain status in work and in life. In response to Norton’s question “what has helped you the most to learn English?” (2000, p. 134), four out of five participants indicated at the outset of her study that grammar, pronunciation and vocabulary instruction were important. (The one who did not indicate this, Felicia, probably had her view of language learning influenced by the fact that she had a husband and children who attended English-medium schools.) However, a year later, all the others except one agreed with Felicia’s comment on the need for “practice, practice, practice.” They stressed the importance of speaking regularly to Anglophones. All of them expressed that they wanted to meet more Canadians socially and to have more opportunity to practice English. Thus their perspective on needs changed remarkably (p. 135). Norton’s data also
indicated that the opportunity to practice speaking English outside the classroom depended largely on immigrants’ access to Anglophone social networks, which was not easy to achieve for her participants (p. 135). Norton’s study can thus be regarded as one more study that considers language needs broadly, rather than being limited to grammar and vocabulary items.

3.4 A proposal for an alternative perspective on needs

The uniqueness of the way needs are perceived in this dissertation is that here I am arguing that a view of needs that is limited to language needs is inadequate if we focus on IGSs’ practice. By focusing on practice, I am proposing that we can see how needs from IGSs’ viewpoint are and what will support their needs. In this sense, the way needs are perceived in this dissertation is quite different from conventional NA research in SLA.

Perspectives on what supports needs are different according to the theoretical viewpoint on learning. The following summary of the learning curriculum and a teaching
A learning curriculum is a field of learning resources from the perspective of learners, an insider perspective. On the other hand, a teaching curriculum consists of items specified by the instructional side and reflecting their external view of what knowing is or should be about, an outsider perspective of learning.

In accordance with different perspectives on learning, the view of what should be prepared for learners naturally differs. That is, from a teaching curriculum perspective, a method of instruction for learners should be designed, which is composed of a series of procedures for improving the skills and competence of a learner as an individual.

According to this perspective, the needs for IGSs are such things as specific vocabulary and grammar points, and conversational patterns necessary for research and life. Designing the instructional method for these linguistic items in the classroom is the way to respond to the needs of the IGSs. NA for JSL/JFL has generally been done from a teaching curriculum or design for pedagogy approach. Needs have been limited to those
connected to the acquisition and use of the Japanese language, and NA has been conducted to improve classroom instruction.

On the other hand, for a learning curriculum, needs must be reconsidered as something more broadly related to one's work or life. For example, for IGSs, being science majors, their primary objective is not to improve Japanese language ability, but to conduct experiments, write academic papers, and complete their degrees. This being the case, their needs can be reconceptualized more concretely as what is necessary in order to support their conducting of research and writing academic papers. From this perspective, the following issues should be investigated, for example:

1. In order to conduct research, what kinds of resources, social organization and opportunities support participation in a lab CoP, and access to lab practices?

2. What kinds of resources, networks, and collaboration are needed in order to support IGSs' research?

Japanese language learning opportunities would also be provided by participating in a lab CoP. Participation in the lab CoP allows IGSs opportunities to interact with
Japanese members, and these can be also regarded as opportunities for learning Japanese.

Therefore, in order to clarify IGSs’ needs in actuality, the first thing to do is to examine how a lab’s practice is organized and how participation in it is achieved. Moreover, it is necessary to clarify what enables IGSs’ participation or what prevents their participation in such labs. By shedding light on these issues, it is possible to identify conditions for supporting IGSs’ needs, for instance, conducting experiments and writing academic papers.

By elucidating these needs, the kind of design necessary for the learning environment of IGSs can then be specified. That is, it will be possible to specify what kinds of resources, social organization, and other forms of opportunities supporting members’ participation in a CoP and access to practice should be arranged.

In short, from the perspective of learning curriculum, the design of the learning environment can respond to IGSs’ basic needs, such as accessing practice and conducting research. Further, accessing practice and conducting research are inseparable from having opportunities to interact with Japanese colleagues and to use and/or learn language.
The above perspective of design for learning environment is different from merely taking an insider view of learner needs. For example, both Jasso-Aguilar (1999) and Narita (1998) used interview and participant/non-participant observation methods in situations other than language classes for exploring learner needs. However, what they focused on was language needs in learners’ practices. That is, they explored language needs in practices including work and graduate study, while assuming that their results would be applied to designing teaching curriculum in the second language classroom.

However, design for learning environment is not merely a design for teaching curriculum from the learners’ perspective. Rather, the focus is on such points as how enabling resources for participation are arranged from the learners’ point of view, and how learning opportunities are organized. These language learning resources and opportunities can best realized within ways of design for learning environment in a CoP.

It is from this perspective that I try to interpret needs from the IGSs’ point of view in this research. In so doing, I will use the framework of situated learning theory, which I will review in the next chapter.
4.1 Introduction

As one step toward better understanding the problems which IGSs in Japan face, and contributing to a solution in relation to Japanese language training, I analyzed the needs of IGSs as they revealed themselves within a Japanese science lab community. In order to develop an understanding of IGSs’ needs as achievements within various layers of social context, I conducted long-term ethnographic research on the practice of a Japanese science lab community, involving multiple layers of activities, and the vital information and artifacts for conducting research. Such an analysis had not previously been done to my knowledge. To guide my research, I focused on answering the following research questions.

4.2 Research questions

As discussed in Chapter 3, when needs are reconsidered as something in terms of
practice, such as to conduct research, write academic papers, and complete their degrees, then participation in the lab community is a prerequisite for achieving those needs. When we reformulate the issue of needs in this way, the following three can be identified as research questions necessary to be responded:

1. How do the IGSs participate in the lab CoP? Through what kind of individual situations and activities do IGSs participate in the CoP? How are these individual situations and activities organized in the CoP?

2. What enables the IGSs' participation in the CoP? What hinders the IGSs' participation in the CoP?

3. In order for IGSs to conduct their own research (such as conducting experiments, writing papers, giving presentations, and completing a degree), what kinds of resources, social organization and opportunities support participation in a lab CoP and access to lab practices?

Asking how the IGSs' participation in the CoP is achieved is at the same time asking about how various opportunities for interacting are organized. The opportunities for learning language cannot be separated from this organization of opportunities for interaction. Responding to the research questions above will clarify concretely what kinds of support are necessary for the IGSs to participate in the lab CoP.
4.3 Methodology

Identifying IGSs' needs requires a understanding of their ways of participation in the CoP and problems related to participation, and this involves trying to understand all aspects of the IGSs' lab life context. In the ethnographic methodology that I used, longitudinal and cross-sectional participant and non-participant observation in both academic and non-academic, formal and informal settings was combined with interviews to pursue thick description (Geertz, 1973). Also, collection and analysis of documents and other artifacts contributed to the interpretation process.

The overall design of my research can be best understood through the tree-diagram included as Appendix 1.

4.3.1 Participants

The total number of participants in this study is 129; in the detailed ethnography section of the study, I focus mainly on two participants, both IGSs. First, I will describe
the 42 participants in the longitudinal component, and then the 87 participants of the cross-sectional component.

For the longitudinal component I joined Dr. Suzuki’s applied physics lab, S Lab. There were three European and three Asian full-time student IGSs in S Lab. In this study, I will focus on two of the European\textsuperscript{3} IGS participants, Karl and Max; I will also discuss data from two Japanese doctoral students who worked in this lab. The two Europeans in S Lab had no prior knowledge of Japanese, and were from a country sending relatively few IGSs to Japan. Thus, with few pre-existing linguistic or networking resources\textsuperscript{4}, they were

\textsuperscript{3} I have asked the European rather than Asian students to participate in my study for the following three reasons. First of all, since most of these IGSs still had low level Japanese proficiency, it was easier for me to communicate with those who have relatively higher English proficiency, and the Europeans tend to be much stronger in English than the Asian IGSs. The second reason for choosing European students is simply that non-Asian students (though not all of them) tend to be less inhibited than Asians about discussing their problems. The third reason is that European students have a relatively harder time than Asian students fitting in, and thus tend to have more problems in both academic and daily life.

\textsuperscript{4} The Chinese and Korean student populations are much larger, but they are more familiar with Japanese culture and many aspects of life in Japan. The Chinese characters used in Japanese are very foreign to Europeans, but not to Chinese and Koreans. Thai and Indonesian students also had large communities. Another difference is in existing networks. One European IGS told me when a European student arrives in the dorm, his room is almost empty (for several weeks until he finds
especially likely to feel the full brunt of obstacles, and the need to manage their
difficulties without assistance or communal support.

The data from the Japanese doctoral students Fumiko, a female, and Jun, a male,
provides an opportunity to see how individuals who are fully participatory members in
Japanese society at-large manage the difficulties of their participation in the lab CoP. As I
will demonstrate in Chapter 8, Fumiko shared some characteristics with IGSs in this lab
even though she is Japanese. Besides being the only female in the lab, she had graduated
from a different university and thus had not taken any classes with the other students.

Moreover, she had working experience, and she was more experienced and
knowledgeable about research than most of the other students. What she had in common

time to buy things.) But when a Chinese student comes to his new room, there is already a carpet,
heater, pots, and pans, among other things, and fellow Chinese students. This illustrates a major
difference in their experiences. I have seen Koreans, Thais, Laotians regularly talking or playing
sports together. Muslims from various countries could be seen everyday in the school cafeteria
because they gathered there after their noon prayer. These students have others to consult with
about problems they encounter, from how to buy a particular food item to problems with their
professor. One European IGS told me that he could not find a particular type of cheese in Japan
for years, but it turned out that it was regular cottage cheese, sold in most big Japanese
supermarkets. He said he had asked his European friends and some Japanese, but they said that he
would not find it in Japan.
with the Europeans was that she was an outsider who had to make her way into the lab community. She provided an interesting comparison with the European students with respect to her identity formation and her access to resources. In contrast to Fumiko, Jun started his S Lab life as an undergraduate (senior). However, he was different from other Japanese students in the lab in that he went to Europe for a year and came back with English communicative ability and a new orientation toward research life style. His English communicative ability and European research life style he brought back from abroad influenced younger generation of students in S Lab. The total number of participants in this study is 129. First, I will describe the 42 participants, and then 87 participants of the cross-sectional component.

Breakdowns of the participants in the longitudinal component are given in Table 1 and 2. Table 1 is the description of the main participants (S Lab members) of the longitudinal component, whereas Table 2 is shows the status and ranking of all 42 participants in that component. (Although the two Master’s students, Karl and Max, are
the main focus of this study, there was also a doctoral student, Peter\textsuperscript{5}, who was very observant and who was able to provide interesting comments from his experience as an IGS. Thus I will include background information about him as well. )

\textsuperscript{5} Peter offered me many interesting comments and interpretations at the beginning. However, he made it explicit that he did not want to be one of the main participants to be studied.
Table 1. Main participants of longitudinal component (Members of S Lab)

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>Origin</th>
<th>Degree goal</th>
<th>English ability</th>
<th>Japanese ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>M</td>
<td>Eastern Europe (same as Peter)</td>
<td>Japanese M.S.</td>
<td>Hardest to understand among the three initially (lots of L1 transfer); improved very much during stay in Japan.</td>
<td>Did well in the intensive program; improved very much during his stay in Japan.</td>
</tr>
<tr>
<td>Karl</td>
<td>M</td>
<td>Western Europe</td>
<td>European M.S.</td>
<td>Very high</td>
<td>Fixed phrases, e.g. “Arigatoo (Thank you)”, “sayonara (good-bye)”</td>
</tr>
<tr>
<td>Peter</td>
<td>M</td>
<td>Eastern Europe</td>
<td>Japanese Ph.D.</td>
<td>Stronger than Max initially; improved very much during his stay in Japan.</td>
<td>Did not do so well in the intensive program</td>
</tr>
<tr>
<td>Fumiko</td>
<td>F</td>
<td>Japan</td>
<td>Japanese Ph.D.</td>
<td>Could express most of what she wanted to say; weaker than the Europeans</td>
<td>NS</td>
</tr>
<tr>
<td>Jun</td>
<td>M</td>
<td>Japan</td>
<td>Japanese Ph.D.</td>
<td>Very weak before he went to Europe; after he came back, strongest in English among Japanese students</td>
<td>NS</td>
</tr>
</tbody>
</table>
Table 2. Participants in longitudinal component

<table>
<thead>
<tr>
<th>Status</th>
<th>Ranking</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>Ph. D.</td>
<td>7 (3)*</td>
</tr>
<tr>
<td></td>
<td>M.S.</td>
<td>19 (4)</td>
</tr>
<tr>
<td></td>
<td>Research student</td>
<td>1 (1)</td>
</tr>
<tr>
<td></td>
<td>B4 (undergraduate)</td>
<td>5</td>
</tr>
<tr>
<td>Faculty/ Administrative staff</td>
<td>Professor</td>
<td>2^6</td>
</tr>
<tr>
<td></td>
<td>Assistant Professor</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Research Associate</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Technician</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Secretary</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>IGS specialist</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>42</td>
</tr>
</tbody>
</table>

*Parentheses indicate the number of IGSs. “7 (3)” means seven Ph.D. students among which three was an IGS.

^6 The number of professors are “two” in this longitudinal component because I often conducted data collection in S Lab’s neighboring lab, M lab. M lab and O lab shared many machines and students were close to each other between these two labs. Although professor M and M lab are never mentioned in this dissertation, I have interviewed M lab’s Japanese students about their lab life in order to deepen my understanding about lab life.
I incorporated the cross-sectional component in this study to increase the
credibility and dependability of my data and interpretation. In order to illustrate coherent
whole, multiple sources of data complemented each other. The data collection for the
cross-sectional component started in 1998 until 2004. Main participants are from the
same university as S Lab is, but also other universities both in Japan and in Europe as
well as the U.S.

For the cross-sectional component, 62 students and 25 faculty and administrative
staff members were interviewed, formally and/or informally. In addition, one officer
from MEXT (Ministry of Education) was interviewed informally.
Table 3. Participants in cross-sectional component

<table>
<thead>
<tr>
<th>Status</th>
<th>Level</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>Post-graduate</td>
<td>62 (49)</td>
</tr>
<tr>
<td>Science Faculty</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Language teacher</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Administrative staff</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Faculty from other</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>universities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government official</td>
<td>Officer from MEXT (former</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ministry of Education)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>87</td>
</tr>
</tbody>
</table>

4.3.2 The intensive language course

The intensive language course that the two European IGSs (a master level student Max and doctor level student Peter, but not an exchange student Karl) completed was a full-time 27-hour per week non-credit course, with a total of approximately 400 hours.

Most government-sponsored students participated in it, but some (like Karl) did not participate, since it was not mandatory. Hardly any Chinese or Korean students were
government-sponsored, and thus there were few of these nationalities in the course, despite the fact that there were many in the campus community. However, Chinese and Koreans have large communities; thus they usually have people to ask for various kinds of help. Chinese and Japanese share Chinese characters, though their writing systems are not completely the same. Koreans have a different writing system but some of them can read Chinese characters. (This depends on the generation and the choice of the second language at school.) Koreans improve Japanese language ability fast because of shared syntactic, phonological and semantic features between the two languages. There were three levels in the course and almost all the IGS participants in my overall study started at elementary level Japanese.

There were about 12 students7 in the elementary Japanese course studying speaking, listening, reading, and writing, taught by seven different teachers. The medium of instruction is English and Japanese, with Japanese progressively taking over from English. Students tended to use English to ask complex questions, and the answers, if

7 When there is space available, Chinese students sometimes join the class.
also complex, were usually given in English to ensure understanding.

The first half of the course was taught using an in-house textbook which emphasized learners' self-expression. The latter half of the course was organized around parts of *Situational Functional Japanese, volumes 1-3*, by the Tsukuba Language Group (1991-1992), and included supplemental skills components, notably reading and *kanji* classes. Because of the limited time, low starting proficiency, and the variety of majors served, the course did not focus on academic Japanese. The students in this course were from all over the world (Asia, Eastern & Western Europe, North, Central, & South America, Africa, Australia, Middle East, Russia), generally with just one or at most two from each country, and with majors in a variety of fields (though mainly hard science).

Below is the description of the intensive language course from the official program webpage. Although this webpage did not exist while Peter and Max were in the program, the goals and objectives as well as rules contained here were in place during the period of their language study. It is slightly modified to maintain the anonymity of the institution where the study was conducted.
Program description
This program focuses on communication skills in daily life, and stresses knowledge as well as skills necessary for academic activities such as presentations and academic papers. … Participants must be our university’s students of this university; graduate students, research students, or exchange students – and the priority is given in this order if the enrollment exceeds the size limit. Students must be able to attend all the classes, and must have the approval of their academic advisors.

Further description of the program follows:

The students do NOT HAVE ENOUGH TIME to join the research activities of their own laboratory, while taking this Japanese language intensive program.

I heard some IGSs deploring how their professors were not happy about them learning or continuing Japanese in class. Science professors want students to spend time on research (experiments) thus they tend to think lightly of Japanese language classes.

Thus, faculty members of the Japanese language intensive program were also struggling to make science professors understand the importance of the program. The description above was not public written document when I started my data collection, but this was added to raise consciousness of science professors about the Japanese language program.
4.3.3 Types of data

Data from observed activities and informal interviews were written up in field notes immediately after the activities were observed or the interviews were completed. Other data include: audio tapes of formal interviews; video recordings of lab meetings; field notes of graduation presentations of master’s and doctoral students; OHP and Power Point slides and printouts of scripts for master’s students’ graduation oral presentations; e-mail sent to the whole lab in mailing list format; e-mail exchanged between the researcher and participants (IGSs and Japanese members); publicly available printed and digitized materials, such as the lab’s annual report, course schedules, university websites, lab newsletter, bi-monthly campus magazines, irregular publications about student life, and newspaper articles about relevant topics like university reform, the shrinking numbers of students, and IGSs in Japan; printed and digitized materials of the lab intended mainly for internal use, such as the lab’s “Who’s who” produced by the students each year, and students’ official and private web pages, the latter being linked from the
The use of different types of data contributed substantially to a thick description of the IGSs' situation.

4.3.4 Longitudinal Observation

In order to gain an understanding of IGSs' participation, I visited S Lab one to three times a week from May of 1999 to December of 2003, and observed members' daily, monthly, and yearly activities. I also read and exchanged e-mail and conducted interviews with Peter and Fumiko. I asked to be included in S Lab’s mailing list thus I knew the lab’s events and other notices. Mainly in response to their posting in lab’s mailing list, I also exchanged e-mail with other members.

The time and day of the week of the visits were alternated to ensure that I would understand the changing dynamics of interaction in the lab when different students and faculty members were present or absent. In non-participant observations of S Lab’s daily
activities, each visit was generally 1-2 hours (though sometimes 3-4 hours), whereas the meeting (non-participant) observations lasted 3-6 hours. These observations include:

experiments students’

The extended spans of time that I spent with the lab community members were the three-day summer retreats for each of three summers, when I spent three full days with them. I also observed experiments in a non-participant manner. I experienced the different activities that new apprentices take part in, as far as I was allowed. For example, I visited classes for master’s students and observed the degree of interaction between professors and students (both IGS and Japanese), between IGSs and Japanese students, and among Japanese students themselves. These observations helped me understand the IGSs’ relationships with the other CoP members and with the physical environment, and thus gave me insights into their access to the learning resources dependent on these relationships.
4.3.5 Interviews

The main purpose of the interviews was to deepen my understanding of data that I gathered from observations. Observations led to my initial understanding and interpretation, and interviews added the CoP members’ perspectives to my data.

I started interviewing students in 1998 prior to the start of my regular visits to S Lab. Interviews were conducted both with participants in the cross-sectional component (members of other labs as well as administrative staff and Japanese teachers) and with participants in the longitudinal component (S Lab members.) Formal interviews were semi-structured, tape-recorded 1-2 hour interviews, in contrast to informal interviews which were less structured, unrecorded, and varying in length. The interviews in the cross-sectional component were with 47 IGSs (6 formal, 41 informal) and 26 Japanese of different statuses (10 formal, 16 informal), as well as informal interviews with two professors in Europe, one with an IGS from one European country studying in a different European host country, and one formal interview with an IGS from South America who had studied in Japan before moving on to the U.S. to complete a Ph.D. I also interviewed,
a European and Asian students who moved between Japan and their home countries.

With participants in the longitudinal study, 27 formal interviews were conducted, and informal interviews were conducted with an additional 30 participants.

The majority of the interviews were one-to-one, but a few were informal group interviews. The questions were descriptive questions, which included “grand tour” (Spradley, 1997) questions (“could you tell me how you do your experiments?” or “could you describe a typical day?”), and mini-tour questions (including task-related “mini-tour” questions, such as “so what happens if you change the angle of the lens inside a vacuum chamber in the laser deposition machine?”). After inquiring about lab procedures and ensuring that interviewees were comfortable with the event, I proceeded into questions about communication and social relations. However, even the procedural questions were often imbued with social significance. For example, the angle-changing question above revealed information about the reluctance to have other lab members touching the equipment.
Especially at the outset of the field work, some students seemed not very communicative and some were hesitant to interact with the researcher. I gradually developed rapport with the Japanese members by participating in various activities, both academic and non-academic.

I struggled to become a member, and tried various strategies to mingle with them, for example, by joining their end-of-year lab cleanings (three winters) scrubbing the floor and polishing windows with them. As it turned out, the most effective thing in the end was to become a food provider for the lab. I brought food (fresh fruits, sweets and homemade snacks) from time to time. In winter of 2001, I started taking homemade warm food (for example, blue cheese pasta, sandwiches, salmon sushi, salad and fresh fruits) to the lab late at night (around 10:00 or 11:00 pm), a night before their final master’s presentations. This was not a conscious strategy, but I did this because I wanted to help and support students at their most difficult time, and also participate in some way. However, I could not do this from the beginning. When I took a homemade banana bread to what Professor Suzuki called “a tea party (intended as Karl’s welcome party)” in fall
of 1999, I was appalled by how formal it was and I could not take the banana bread out of my bag. Offering homemade sweets would clearly have been out of place. There was no real tea or freshly brewed tea or coffee at this “tea party.” Instead, canned drinks, such as soda and coffee, were provided. The event consisted of a series of introductions by Japanese students of their research topics, and Karl introduced his country with Power Point slides.

As I will discuss in Chapter 8, finding a unique position in a CoP is very important for participation. I found my “position” as a food provider of the lab and the members eventually accepted me as such. Having such a position enabled me to access various situations and activities thus it made my description (based on observations and interviews) much thicker.

Interviewing Karl and Max was also not so smooth at the beginning, either. In the interviews, I stressed the confidentiality of the interviews, however, they would not tell me much about their lab life. Then I invited Karl and Max over for dinner in February of 2001. We left my house together after 11:30pm to go barhopping, and I stayed with them
until 5:20 am. That “data collection session” was the first time they told me about Karl’s access problem (main topic of Chapter 6). They did not tell me about their problems during the dinner in my house.

On other occasions, I stayed with Japanese students while they were drinking on summer trips, and went to karaoke with the Japanese students after farewell parties. I could hear more about their lab life especially when no faculty members were around, and/or they were drinking. Thus I collected crucial data when a more informal atmosphere (either with or without alcohol) was achieved.

As I observed various activities, I formed informal hypotheses and interpretations. When I entered the field, I did not have situated learning theory as my theoretical framework. Even after I read Lave & Wenger (1991) and Wenger (1998), I could not fully understand their theory. However, while I was collecting data, and trying to find a theoretical framework, I rediscovered various new aspects of this framework. Having my own data helped me understand the theory at a deeper level at the same time that a new
understanding of the theory enabled me to perform more productive analyses of my data.

In this way, my understanding of the theoretical framework and the analysis of data mutually supported each other.

Interviews supported or disconfirmed my hypotheses and interpretations, and facilitated fine-tuning of the understanding process. The hermeneutical process of cyclically focusing on the parts and the whole guided me toward understanding the lab CoP. When I discovered an unfamiliar phenomenon either by observation or by interview, I followed up by asking other S Lab members or members of other labs about it, with the goal of achieving triangulation. Through the interviews, I gained access to both descriptive information and interpretation from participants’ insider perspectives. My findings were informed by multiple voices as well as my observations on multiple occasions across multiple activities.

4.3.6 Another type of data

Some of printed materials were used as data for knowing the members themselves
and their positions in the CoP. One of the printed materials is “Who’s who in the lab,” a booklet about the lab members that is compiled annually by a group of [incoming/new Master’s] students and distributed to all lab members just before the lab’s summer trip. In the booklet, lab members are presented by rank, starting with the professor, then the associate professor, the research associates, secretaries, and finally the students according to their ranking (from doctoral students to senior undergraduate students.) Each member is asked to write his/her research group name, and bio-data such as birth date, age, blood type, zodiac sign, personal preferences (music, books, likes and dislikes, favorite hangouts and/or pastimes, etc.) and self-revelatory ideas in response to a number of questions. There are about 25 to 30 items in total. The questions about personal preferences and ideas change slightly each year. Members are not required to provide answers to the questions. For example, in 2004 edition, Professor Suzuki wrote only his name, birth date, age, blood type, zodiac sign, name of his high school, and where he grew up. In the booklets from previous years, he wrote more, but in recent years he has become too busy to answer questions.
At the end of each person’s entry, there are comments from other members. By reading comments, readers can tell who is friends with whom, who helps who in his research or experiments, who likes to drink, and who made what kind of embarrassing mistakes.

This booklet is a very useful and efficient artifact for accessing the personal information of other lab members. During the summer trip, members have time to get to know each other, and this booklet provides topics of conversation. By using this resource, one can talk easily to someone he does not know very well.

I was also included in “Who’s who in the lab,” and their comments to me and position of my entry changed over the period of time. For example, comments for me in 2002 were “1. S Lab became multi-national, your job seems to increase. 2. I hope the frequency of your homemade food delivery would increase. 3. (following comment 2,) Aggressively agreeing (about more food delivery).” I was placed after all the members. In 2003, comments were “1. Please bring your homemade food right before master’s program graduation presentation. We cannot graduate without it! 2. Thank you for always
listening to my stories. (This was written by one of the IGSs who is not focused on in this
research.) 3. Your homemade food right before master’s presentation was great. 4. I have
the image that you are internationally active.” My entry was between doctoral students
and M2 students. In the lab’s 2004, there was only one comment: “She is a nice person
who always brings homemade food around master’s and bachelor’s graduation
presentation.” And my entry was at the beginning of the student section after faculty
members. This change in the order of my entry is one of the evidences of my position in
S Lab and students’ comments also show my position from their perspective.

4.4 Theoretical view point to methodology

In 4.1, I have been describing my methodology mainly from a procedural point of
view. In this section, I will discuss my methodology from a situated learning theory point
of view. This is because ethnographers themselves can be regarded as one of participants
in the CoP they attempt to study and they have to access to practices in various ways.

Any methodology is not free from how ethnographers can access to practices. Whether
some procedures can be utilized or not depends on how ethnographers participate in the CoP. A mere list of procedural descriptions of methodology does not show how these procedures can be utilized. Thus, the discussion of ethnographers' participation in a CoP is necessary to understand how some procedures can be used.

To my knowledge, there are no documents explicitly written about ethnographic methodology from a situated learning theory perspective. However, this theory does have implications for what an ethnographer is and what kind of ethnography should be conducted.

For example, an ethnographer who is trying to study a particular CoP has a very distinctive position such as somebody whose mission is to supports IGSs, but is also one kind of participant. In reality, an ethnographer also has to access practices, situations, artifacts, other participants, and knowledge in a CoP. In the case of studying a science lab in a university, her access is prevented or enabled as the time passes, though of course not in exactly the same way as IGS and Japanese members.

From this perspective, creating rapport with lab members, and being able to
observe certain situations is not merely an issue of ethnographic technique, but rather is
deeply related to the ethnographer’s way of participation in that CoP. What can be
considered data is not a given. From this perspective, unsuccessful interviews and
observations are not simply unsuccessful methods, but can be very important as data in
themselves. In conducting an ethnographic study, not being able to access a certain CoP
or activity does not mean a failure in the fieldwork. Rather, it is important data. For
example, whether accessing an activity or situation in a certain CoP is easy or not
indicates how open that CoP is to a newcomer.

When an interviewee does not respond to an interviewer, it does not necessarily
imply the failure of the interview. There are cases that this illustrates ways of various
relations in the actual CoP. For example, Karl and Max did not tell me about problems of
access to the machine in S Lab CoP at the beginning. They would simply say, “There are
problems, but it is OK.” By relating various episodes and interview data, I discovered
that Karl and Max’s unwillingness to report problems and complaints explicitly applied
not only to me, the ethnographer, but also to the Japanese members in the CoP. That is,
the fact that Karl and Max would not talk about problems and complaints explicitly did not show that the interviews had failed, but rather, this fact revealed new information about their relationship with Japanese members in the lab. Moreover, their unwillingness to share their problems with meshows that I was not seen as Karl and Max’s comrade (or their supporter) by them, but as one of the Japanese in the Japanese group.

In addition, Karl and Max eventually told me details of their dissatisfaction about access to the machine. This was when we were drinking (I was drinking soda after the first couple of glasses of alcohol) together until early in the morning. This does not simply show a success in an informal interview. It also shows how I was able to access the situation, which Karl and Max shared.

Through conducting various interviews, I strongly feel that time, space, artifacts and people around interviewee(s) facilitate and/or limit certain aspects of interviews as structuring resources. It was the drinks, the lateness of the night, the darkness of the bars, and the size of the drinking places, which worked as resources to structure the settings in and/or conditions under which they were able to tell me their problems. Until then, Karl
was telling me that “there were problems, but it is all right” without describing the details.

One insight from this experience is that I could hear more about what was happening in the participants’ lab life in bars. However, this cannot be reduced to a “how-to” issue of approaching these kinds of situations. Because the first and foremost issue is whether an ethnographer can access these kinds of situations or not. At the beginning of my research, I wanted to join an informal drinking gathering of Japanese students and the IGSs. I was never invited and I did not feel that I could easily ask whether I could join them or not. They treated me as a person who was not supposed to be in the informal situation. I was not accepted in those situations, and I was not allowed to be there. It was a long time after I started fieldwork when they asked me to join them. Before being accepted, I met them in various situations, chit-chatted with them, and brought homemade food to them. Through obtaining a position in the CoP, it became natural for them to ask me to join them.

Considering these things, it is possible to say the quality of an ethnography
depends on how much an ethnographer can access activities and situations in a CoP.

At the beginning, I entered S Lab without formal institutional endorsement like Karl (who did not belong to the Japanese university system as an MS student), and it was very difficulty to access various things. For example, Japanese graduate students did not ask me to join them when they went out drinking together. When I interviewed IGSs like Karl and Max, they would not tell me what kind of difficulty they were facing in reality.

Through trying various “strategies,” by participating in summer trips and parties, and by bringing home-made hot food during the “toughest” time of their student life in winter, gradually I could access practices in this CoP. Finally I was invited to karaoke parties after the lab’s formal farewell parties and became able to access their “backstage” (Goffman, 1959). They would not show their “backstage” in the formal situations. Thus my approach was a little different from other new members in S Lab, but through participating in various activities and situations, I became able to access the practice of the CoP.

Through this kind of trajectory, I realized that the difficulty I faced in accessing
the practices of the lab, and the situation Karl and Max shared, was not an indication of
the failure in my fieldwork, rather, it suggested qualities of the CoP. It also became clear
that these difficulties of access indicated the nature of the relationships between Karl and
Max, and between them and the Japanese graduate students.

The position I obtained in this CoP was unique in the sense that it was different
from those of Max and other newcomers from the beginning. For example, I entered the
lab as a kind of supporter of IGSs who could easily communicate with IGSs in English. I
did not practice science as a subject, and I was not seeking a degree in science like other
new members of the lab. Moreover, even though I am Japanese, because I could speak
English, my communication with Karl and Max was easier to a certain extent than that of
the Japanese students communicating with them.

From the above discussion, it follows that ethnographic methods such as
observation and interview will not become possible by taking certain fixed steps. It is
largely dependent on the way of participation in the CoP where ethnographers try to
approach. That is, even if an ethnographer adopts ideal observation and interview
methods, if she cannot access the various situations and activities of the CoP she is studying, the data she obtains only shows very limited aspects of that CoP.

Thus, participant observation in fieldwork will not become possible simply by being in a situation where a certain activity is happening. It becomes possible by an ethnographer participating in the CoP by gaining a certain position, which gradually enables varieties of access.

Ethnographers are expected to approach various situations or the place of action and willing to participate in the lab CoP exactly as one of IGSs, Max shown in detail in Chapter 6, was willing to participate in various situations and activities. Participating in various activities and being in a variety of situations and interviewing is not just a matter of technical know-how of ethnography. It includes participating and gaining a position in a CoP beyond collecting a variety of data in various situations. These things will enable an ethnographer to access various aspects of a CoP. The trajectory of participation and learning is also expected of an ethnographer in order to understand various aspects of the nature of the CoP.
In sum, situated learning theory can be a resource for understanding a CoP and members’ ways of participation in a CoP. Moreover, it can also be a resource for evaluating an ethnographer’s access to a CoP, and interpreting the meaning of interview data and the observation of various situations.

In fact, this theoretical perspective on ethnography was not explicit at the onset of my fieldwork. This viewpoint concerning methodology gradually became clear as I conducted my fieldwork. This theoretical viewpoint on methodology was very useful when I tried to specify the meaning of each interview and observation and the relations among my data.

In the following chapters, I will describe how IGSs participate in the lab or how they have difficulties to participate in the CoP. Before going to the cases of IGSs, in Chapter 5, I will discuss scientific practice as background for presenting the data involving the issue of access in Chapter 6.
CHAPTER 5
SITUATED PRACTICE IN A LAB

"Once a machine is made, it's over." (Honda)

In this chapter, before describing and analyzing actual cases, I would like to introduce my research site by taking a look at the daily life and practices in the lab. It is necessary to focus on everyday life and practices in the lab in order to know how the opportunities for interaction and language use are organized. Thus, in this section, I will illustrate how experiments, as the major activities in the lab, are conducted, how various resources are arranged and utilized, and how knowledge is socially distributed in the lab. In doing so, I will describe everyday practice in the lab, seen from lab member’s perspective.

I will focus on three things to clarify how lab practice is going on. First, in labs, science is practiced as science, not as part of a teaching curriculum. Experiments conducted in labs are different from classroom experiments in secondary educationwhere
experiments are easily replicated. In the lab, graduate students serve as research assistants to a professor, who conducts research in his area of expertise. Unlike classroom experiments, where there is prepared equipment and fixed procedures to follow, in labs, experimenters have to use existing equipment creatively. For example, make adjustments to manage unexpected obstacles in a situated and interactive manner while conducting experiments. Second, in labs, details of “how to use machines in what way” are situated, that is, research theme-specific and lab-specific. Therefore, the product manuals are not enough for actual research. Third, there is no single individual in the lab who knows everything; rather, knowledge is socially distributed. As Lave & Wenger (1990) pointed out, “mastery resides not in the master but in the organization of the community of practice of which the master is part” (p. 94). For example, there are three main topics of research in S Lab. Professor Suzuki, the professor in charge of S Lab, stopped conducting experiments some years ago although he understood all the members’ research quite well. In other words, the professor supervised the lab project, but he did not necessarily know the details about machines (such as how much heat one machine could produce) or
experimental methods. In scientific research I studies, I discovered situated aspects, and social aspects (knowledge was distributed among members) in the group work that is often needed in order to conduct experiments and research.

5.1 Laboratory Life

At the beginning, I will outline the lab life of S Lab: how community members spend the time, how experimental rooms and offices are arranged, and how the experiments of S Lab are conducted.

Time

In this lab, almost everybody seemed to be in the lab from morning until night, especially toward the end of the year, in November and December, when master’s students were facing graduation thesis deadlines. A typical day for a first-year master’s student as follows. He arrives at the lab around 9:30 or 10:00 am, then goes to class from 10:30 until noon. After the class, he goes to the cafeteria to eat lunch with other first-year
students. He and his peers chat about the class, homework, exam, and their experiments, as well as music or other non-academic topics. At 1:00 pm he goes to class until 4:10 pm. After finishing classes for the day, he then reads journals related to his research topic, or works on his experiments, or does homework until dinner time. Around 6:00 pm, before the cafeteria closes, he goes out to eat dinner with the same members. Around 9:00 or 10:00 pm, he leaves the lab. There is an easier day once a week when master’s students have no classes. Then the student will sleep in and arrives at school around 11:00 am. Still he eats lunch and dinner about the same time with the same members, and his activities are the same as above, except attending classes. He goes home around the same time.

Staying in the lab until the last train leaves around midnight was not an exceptional situation for many of the students before deadlines. Depending on the theme, once an experiment starts, students sometimes had to stay in the lab overnight. In some rare cases, the experimenter had to wait to conduct an experiment until trains stop
running to avoid subtle trembling that occurred when trains passed through the nearby train station.

**Space**

There were two office spaces for students in S Lab: *oobeya*, the big room (See Appendix 1 for a diagram of the layout of this room) and *tabako beya*, the smoking room. The offices served as the quasi-living quarters of the students. In the big room, there were 15 students and three faculty members (an associate professor, and two research associates.) Professor Suzuki had his own private office. Usually, IGSs and Japanese students referred to their big *oobeya* office simply as *kenkyuushitsu* (lab) in Japanese or *the lab* in English.

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8 Between late fall and winter, some students told me that they only go home to sleep. When I asked a student why he usually came to the lab even on weekends, he responded “there is nothing to do at home really and I am alone, but in the lab, I can use internet for free and meet someone.” It is not unusual to spend about 12 hours in labs.
My first impression of the big room was that it was crowded, but it was not so different from several other physics labs I had been to. There were cables hanging all over the ceiling for LAN (Local Area Network) and internet connections in the room, and the room was dark because big sheets of paper were covering parts of the big windows to block direct sunlight. Also, tall bookshelves placed in rows made the office dark.

Moreover, because of these tall bookshelves, one could not see who was there unless one moved around the room. Later, I realized that the bookshelves also had the function of blocking other people’s view to create individuals’ space where they could feel a little private in this crowded office.

When I started this fieldwork, I once was advised to sit in the corner where I could see everyone, but there was no space to create a corner seat facing the room. There was no single Panopticon-like spot (Foucault, 1975) where I could see everyone. There were 22 desks for people to use and six desks for three shared computers, all of which were used by 15 students and three faculty members. The associate professor had three

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9 When I asked a research associate about this paper blocking sunlight, he did not know why, but he said it had always been that way.
desks and a cubicle area by the window, two research associates had two desks each, and
the students had one desk each. Not everybody was there all the time since some were
using machines in different institutions. However, almost everyone had his own private
computer in the lab. Their monitors were facing slightly different directions that no one
could see what anyone else was doing. Students and the research associates were wearing
headphones to create their own space in this crowded room. The headphones functioned
as “do not disturb” signs in the lab, it seemed.

Experiments were conducted in different places: an experimental room across the
hallway from the big office, another one on a different floor, one in a different building
on campus, and two other locations in different research institutes a couple of hours away.
This is because machines were shared among several labs. Single lab cannot afford to
have all necessary machines for experiments since some machines are extremely
expensive\textsuperscript{10}. Thus it took one of the IGSs one year before he knew all the experimental
sites of S Lab.

\textsuperscript{10} A typical machine would cost several million dollars. A small machine would cost several
hundred thousand dollars.
One of the experimental rooms was on another floor, and in this room there were machines on the left hand side of the room, which was divided by a partition. The right half of the room was used as a storage space. There were old computers, some desks as well as couches, old books and journals, etc. I did not realize that this room was used as a bedroom until I heard a student mention a "nebeya, (sleeping room)." There were blankets on these couches and up to three people could sleep, although three would make the sleeping uncomfortable, according to the users. One of the students brought a portable bed to the lab office, which was shared with his friend. I have seen one student sleeping by spreading a piece of cardboard on the floor in winter. (He was sleeping overnight in order to finish his Master’s thesis.) When students could not obtain good results before deadlines (for graduation presentation, conference presentation, and journal), they would become desperate, and would continue conducting experiments one after another, from morning till night.
Members and activities in S Lab

There were about 25 members including four faculty members (Professor Suzuki, one associate professor, and two research associates) in the lab. The total number of the members fluctuated over the four years of my study. The student body consisted of 4-5 first year Master’s program students (they were called “emu ichi, M1”), 4-5 second year students (emu ni, M2), 2-5 doctoral students, and 6-8 senior year undergraduate students. There were three research groups in this lab. Each group had 5 to 8 students and one faculty member who led the group; and each group had a distinct research theme. All the international students were in the largest group because that experimental theme was what S Lab was most famous for. Depending on the group’s theme, the workload or time commitment was substantially different. Some students chose a theme because it involved the least work, but others had chosen themes because of their own interest.

Members of one of the groups had to commute 3 hours everyday as well as pay their own travel expenses to conduct experiments in another institution; however because it was an

\[^{11}\text{On the official record, there were 5-18 visiting scholars, research students, and post-doctoral fellows. Some of them came to the lab everyday, some of them I never met.}\]
independent institution not a university, at 5 o’clock, staff left work and the door was locked. Thus students working there could stop experiments at 5 o’clock. One student told me that when he entered the master’s program, one group did not have enough members, so janken, paper-scissors-rock\textsuperscript{12} to decide who should be in this unpopular group.

The summary of lab activities for master’s students is shown below in Table 4. The activities are divided into “Academic activities” and “Non-academic activities” on one dimension, and “Formal activities” (initiated or organized by the university or by the lab) and “Informal activities” (initiated by students) on the second dimension. Detailed explanations of the activity categories will be presented in Chapters 6 and 7.

\textsuperscript{12} Paper-scissors-rock/stone is a very common children’s game in Japan. It is also a good way to decide who is going to take the first choice thus adults use this as well when people want to make decision in a fair way. Paper loses against scissors, scissors loses against rock, and rock loses against paper (rock can be wrapped by a piece of paper.)
<table>
<thead>
<tr>
<th>Activities</th>
<th>Academic</th>
<th>Non-academic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formal</strong></td>
<td>Classes</td>
<td>Seasonal lab events</td>
</tr>
<tr>
<td>(Institution initiated)</td>
<td>Periodic lab meetings</td>
<td>Spring welcome party</td>
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<tr>
<td></td>
<td>Conferences</td>
<td>Summer retreat</td>
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<td></td>
<td></td>
<td>Fall hike</td>
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<tr>
<td></td>
<td>Research related</td>
<td>Year-end lab clean-up</td>
</tr>
<tr>
<td></td>
<td>Read journals</td>
<td>Year-end party</td>
</tr>
<tr>
<td></td>
<td>Make samples</td>
<td>Farewell party</td>
</tr>
<tr>
<td></td>
<td>Measure samples</td>
<td></td>
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<tr>
<td></td>
<td>Use computers</td>
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</tr>
<tr>
<td></td>
<td>Share artifacts</td>
<td></td>
</tr>
<tr>
<td><strong>Informal</strong></td>
<td>Classes</td>
<td>Lunch/dinner gatherings</td>
</tr>
<tr>
<td>(Student initiated)</td>
<td></td>
<td>Chat in the lab</td>
</tr>
<tr>
<td></td>
<td>Attend the same classes</td>
<td>Smoke together</td>
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<tr>
<td></td>
<td>Sit together</td>
<td>Watch TV</td>
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<tr>
<td></td>
<td>Collaborate on homework</td>
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</tr>
<tr>
<td></td>
<td>Study together before exams</td>
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<tr>
<td></td>
<td>Student-run study sessions</td>
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</tr>
<tr>
<td></td>
<td>Organize</td>
<td>Parties w/o faculty</td>
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<tr>
<td></td>
<td>Participate</td>
<td>Organize</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participate</td>
</tr>
</tbody>
</table>

In the periodic lab meetings – lab meetings were held about once a month –, lab
members presented updates on their research to Professor Suzuki. These meetings also
provided all members of the lab with an opportunity to see the professor. The lab
meetings were one of the lab’s main academic activities in that both students and faculty
members conducted experiments, analyzed data, and prepared OHP and Power Point
slides in preparation for these meetings. The members planned their work so that
experiments would be completed in time for the following meeting. This type of meeting
is held in all types of science labs (in biotechnology, nuclear physics, medical science,
etc.) although there are variations in frequency, style, and purpose. For example, in the
lab meetings of S Lab, students never said anything about other students’ presentations.
There was no discussion initiated from the floor (by the students). When someone other
than a faculty member initiated any comments or questions, the behavior would clearly
mark the questioner as an outsider. When I started visiting the lab, I was asked by
Professor Suzuki to comment on a student’s English presentation. It seemed like a good
opportunity to contribute as a new quasi member, so I commented on it. It was not until
later I found out that the students did not like this kind of comment, which made the long
meeting even longer. One IGS who worked in a nuclear physics lab told me that in his lab all the students participated in the discussion.

Depending on the type of machine utilized, collaborative work in a lab is differently organized. For example, a way of collaborative work of S Lab which works on micro and nano technology, is very different from a nuclear physics lab, where they use very large-scale facilities and it is normal for the list of authors of a research report to take up pages in a journal. Thus in nuclear physics, discussion is open to everybody in lab meetings. In some labs, meetings are held once every other week, and in other labs, only a few per semester. In the meetings of some labs, only a few students present, but in S Lab, most of the meetings involved presentations by all members on the same day.

5.2 Experiments as situated practice

Thus far in this chapter, I have briefly shown what kind of place a lab is and what laboratory life was like at S Lab. Now I would like to describe what kinds of experiments were conducted in the lab, how experiments were conducted, and in what kinds of
physical contexts they were conducted. Here, to help readers understand the situated

nature of an experiment, I would like to compare it with cooking. First, I will examine
cases of cooking in daily life.

Cooking as a situated practice

Cooking and scientific experiments are seemingly very different practices, but in

fact, they share very similar qualities in many ways. This connection is not generally

realized from the experiments that are part of the science curriculum in elementary or

secondary education. Experiments conducted in elementary or secondary education share

some similarity to what Jordan (1987) discussed regarding the midwives’ UNESCO

training course in Yucatan. In both cases, what the teachers teach does not represent

professional practices (midwifery practice in Jordan’s case, and scientific experiments in

labs in this study.)

From what I observed and heard in interviews, I came to realize that lab members’

experimental practice, which had seemed foreign to me at the beginning, was very close

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to what I do in my everyday cooking. Let me start the comparison by describing how I make a bread pudding in my everyday life.

Making a bread pudding

In a recipe, we find the ingredients such as eggs, milk, sugar, bread, the amounts of each ingredient, directions for how to combine them, and the time needed for cooking.

Below is the recipe I used to make my first bread pudding from Better Homes and Gardens New Cookbook.

**BREAD PUDDING**

- 2 slightly beaten eggs
- 2 1/4 cups of milk
- 1 tablespoon vanilla
- 1/2 teaspoon ground cinnamon
- 1/4 teaspoon salt
- 2 cups 1-inch day-old bread cubes
- 1/2 cup brown sugar
- 1/2 cup raisins

OVEN 350 degrees

Combine eggs, milk, vanilla, cinnamon, and salt; stir in bread cubes. Stir in brown sugar and raisins. Pour mixture into 8x1 3/4-inch round ovenware cake dish. Place pan in larger shallow pan on oven rack; pour hot water into larger pan 1 inch deep.
Bake at 350 degrees about 45 minutes or till knife inserted halfway between center and edge comes out clean. Makes 6 servings.

In the real making of a bread pudding, I do more than what is written in the recipe, for example, I first mix only the milk and eggs and then strain the mixture in order to make the texture of the pudding smooth. (This is sometimes written and sometimes not.) Also, I toast the bread before I cut it into cubes, so that the bread will soak up the liquid faster and more evenly.

Once the mixture is finished (with sugar and raisins), I pour the liquid into a container, then put it into the preheated oven. I then look at the recommended cooking time and temperature, and make adjustments to the temperature setting and cooking time based on the shape of the container (smaller but deep or bigger and shallow, for example) or according to the season (hot summer day, or cold winter night when we suddenly discover we do not have bread for the next morning). I keep an eye on the oven throughout the cooking time so that, when the steaming water has evaporated, I can add more.
The heat does not reach the center of the bread pudding well in my square deep Pyrex, so that when I use this container, I have to check with a toothpick whether the pudding is done or not. If the rest is done, but the center is not, then I lower the temperature and extend the cooking time. If it is getting burnt, then I make a “tent” with aluminum foil to prevent further burning.

Sometimes I make adjustments to the amounts of ingredients based on variable factors, such as the size of the eggs. One must be careful with the number of eggs, since the eggs serve as solidifier, and using too many eggs in relation to the amount of milk would make the pudding too hard. If there are not enough bread cubes, by using more eggs, the pudding is not likely to break when cutting it and serving it. This is not written in the recipe, so one has to make adjustments of one’s own.

It is usually too sweet if I add sugar according to the recipe. Thus I put in less sugar, and use fruits such as dried cranberries, or canned pears or apricots to add sweetness.

It is very important to know your oven’s character as well. For example, there is a
variety in how an oven works for baking food. It depends on the size of the oven, and the
source of energy (gas or electricity.) The heat in the oven is usually not even, and thus
depending on the oven, the part that becomes overdone (front part of the center, for
example) and the part that stays uncooked will vary.

Even if the recipe tells you to bake at 350 degrees for 45 minutes, the dish could
be undone or overcooked depending on the oven you use and other conditions. The final
result is influenced by the room temperature and the temperature of the ingredients (milk
and eggs that have just come from the refrigerator in the winter and that are at room
temperature on a summer’s day require different amounts of time.) We learn the
characteristics of our ovens by using them, and we make delicate adjustments instead of
using the recipe faithfully. Thus, sometimes it is difficult to cook with other people’s
ovens or tools. We do not necessarily have a container which perfectly fits the
descriptions in the recipe, so that we need to make time and temperature adjustments
accordingly.

When we make a dish, we do many things that are not written in the recipe. We
also change the way we cook and make subtle adjustments depending on the situation. When we cannot buy the necessary ingredients, we buy something else or try to make the dish with a substitution. For example, if one is living in Japan and trying to make an American pie, even if the recipe says to use shortening, one would use cake margarine (unsalted margarine) instead because it is not easy to buy shortening in Japan. Or if one needs to whip cream and there is no eggbeater or whisk, one can use a couple of forks to whip cream in a bowl, or use a food-saver container and shake it well.

In the everyday practice of bread pudding making and in other cooking tasks as well, we manage to make dishes with containers, utensils and appliances available at hand, by making adjustments of temperature, cooking time, ingredients, etc. In this way, cooking can be regarded as a kind of bricolage. Bricolage (Lévi-Strauss, 1962) is a type of work to create something needed at the time by tentatively managing various materials and tools. These materials and tools are not made for this particular purpose, but rather are leftovers from previous work, or something kept from the past for annon-specific future use. The people who do work in this bricolage manner are called bricoleurs.
In cooking, we devise various methods and ways of utilizing tools and equipment dependent on situations. If one needs to use parsley for a pasta dinner and finds only a green but old one in the refrigerator, one can cut the end of its stem, wet it, put it in a glass of water then put a plastic bag over it, and keep it in the refrigerator for a few hours before actually using it. When it is cold, I heat up my plates to keep the individually served food warm, and also put the serving plate on candle warmers. Like scientists, professional cooks consider all kinds of factors to reproduce the same taste or to otherwise meet their high standards.

I have stayed in other people’s houses, and found that it is hard to cook when I am not in my own kitchen. I do not know where things are. I cannot easily find my favorite cooking utensils and appliances in other people’s kitchens. Utensils, spices, condiments, and other ingredients, and various plates are not easily found. I feel lost. In my kitchen, I know where things are and I arrange them in the way it is easy to use for me. This feeling of being lost could happen to a science student who moved to another country and tried to use a machine which functions the same way as his lab back home. He will find it very
difficult to use the machine until he becomes fully familiar with the new lab environment.

Thus, use of a particular machine is very dependent on the lab environment.

When I am not home, I have another problem of not having a network of sources of ingredients. I know where I can buy cilantro near my house. I know cilantro has different names\textsuperscript{13} according to the stores in my vicinity. When I try to buy cilantro in a new store, I need to try different names because they may carry it, but under a different name. When I am not in my network for ingredients, I do not know where I can get what I need. It may even be impossible to buy some needed item. However, if I have my cooking utensils and my ingredients network, even if I do not have exactly what I need, I know where I can buy something very similar for a substitution in my bricolage work.

\textbf{The similarity of cooking and scientific experiments}

As I wrote, cooking and experiments may seem very different, but, in some sense,

\textsuperscript{13} In Japan, I have seen it sold under the names of: shantsai, kousai, coriander, I have seen it called: cilantro, Chinese parsley, coriander in the U.S.
cooking can be regarded as a kind of experiment. In the case of bread pudding, it is an
application of a chemical reaction just as many scientific experiments are. Eggs work as a
type of solidifier, and since they are protein, they change in form from liquid to solid by
having a type of energy (high heat) applied to them. In scientific experiments, scientists
use high heat, pressure, time, etc., applied to substances and samples to cause chemical
reactions. Thus in science as well, scientists need to be bricoleurs, to be creative in
thinking and flexible enough to make adjustments in order to obtain a desired outcome.

Machine manuals, which serve as recipe books, do not provide all the necessary
information. Thus scientists need to know their machines’ individual characteristics well
in order to obtain consistent results. One lab member told me that a new machine was not
providing him with consistent results. He was troubled because the new machine’s results
were not consistent with the data he had previously obtained even though the parameters
were set the same. He wanted to use the new and better machine, but it did not give him
the consistent results obtained from the old one, although they were supposed to be
basically the same machine. If the conditions of pressure, temperature, strength of laser,
time and settings are the same, the machine should provide the same results. That is the

science myth. In labs where cutting edge science is happening, inconsistencies are not

unusual at all. Scientific practice is a situated practice just as cooking is, as Lévi-Strauss’s

(1962) study on scientific practice illustrates. He points to bricolage and bricoleurs as
typical of traditional culture. As we have already seen, these terms apply equally well to

cooking. A cook will use the utensils and ingredients available and manage to cook. I am

arguing here that it is the same in the practice of science and technology.

**Bricolage in S Lab**

Experiments were bricolage work in S Lab, my research site. Let us take a look at

actual cases.

There was a broken machine in the lab. Karl, a European IGS was assigned to fix

it, and Fumiko, a new Japanese doctoral student, also volunteered to fix it. As it will be

shown in detail in Chapter 8, she made replacement parts for the broken parts by herself

from pieces of metal by using a lathe machine and a milling machine. She made nuts and
bolts as well to fix this machine. She told me that the machine was made in the U.S., and thus the necessary parts were inch-sized, and she could not order them from a Japanese company. If she had ordered the parts from the U.S., it would have been expensive and taken her one to one and half months to actually get the parts because it would also involve bureaucratic procedures of filling out forms and handing them in to the university to order these items.

Fumiko also told me that the grill for the drain of the shower in her apartment had broken. She thought of telling her landlord, but from her working experience in a company, she knew that sometimes the company discontinued these parts of an old model "unit bath." Either way, it would take a while until she could get this grill. She measured the thickness and diameter of it and made a replacement out of plain acrylic board. On another occasion, a research associate of S Lab told me that once an IGS wanted to buy an extension cord. He thought the IGS should make one by himself. There were necessary materials here and there in the lab, and all he needed to do was to assemble them. In contrast, if one wanted to order it, it would take time because of bureaucracy and
one would need to spend the lab’s budget. The research associate thus considered it is much better for the student to make one of his own.

In labs, it is not unusual to make tools by hand with available materials, or to fix machines on the spot. As I will discuss later in detail, having metalworking skills (knowing how to use a lathe machine or a milling machine) could become “technical capital” in a lab. If one knows how to fix a broken machine or create something useful for research, s/he and other members can save time and money. In science and technology practice, lab members are always fighting for time, thus this kind of skill can be regarded as “technical capital” in a lab. The members have to create something new, or discover some new materials or qualities earlier or faster than other labs. Their

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14 “Technical capital” is a type of symbolic capital (Bourdieu, 1977), which is socially-constructed and, in certain situations, may have social value. As I will discuss in detail in chapters 8, certain knowledge or skill could become capital in a CoP.

15 One piece of evidence for this is that they have a “letter”, that is, a short and quick report. This artifact exists in order to publicize what researchers have just discovered as soon as possible, without waiting for full-length publication in a journal. This type of (immediate) advisory is necessary because while the researchers are waiting for the journal publication to appear, some other group might report the same finding in another journal. In technology fields, being the first to report what has been created is crucial for patenting or licensing, the goal of all the work, research and development to which researchers have devoted their time.
machines and tools are often not mass-produced but are special machines made for
specific purposes. It is not surprising that the users become bricoleurs to save time and
money (and also for fun). One can get service and maintenance for machines like copying
machines, but in labs, to have a service technician come over and fix broken machines is
not an easy process. Sometimes technicians are too busy to come right away, and also,
asking professionals costs money. For a lab’s limited time and budget, the members have
to manage as much as they can on their own whatever comes up in their practice of
conducting research.

The technician of this lab, Honda, said, “Once a machine is made, it’s over.” He
added that if a machine is produced and sold by a company, any person can conduct
experiments and reproduce the results, thus it is too late to study that. The important
things are to think of a new experimental procedure, and to create new methods and
know-how. This comment by Honda shows that scientific experiments are not a kind of
practice where an experimenter uses ready-made machines and obtains stable results. On
the contrary, they need to manage know-how and available machines in order to obtain
better results. That is why they can be called scientific experiments, rather than a science class experiment in a school.

"Once a machine is made, it's over" represents the central role that bricolage plays in scientific practice. Scientists use a machine available on the market, but they use it to create something more than the machine can officially produce, and that is the bricolage aspect of scientific practice. When I summarized as the following, Honda sensei agreed and I also confirmed it with Fumiko. "When ready-made machines are available and somewhat stable results can be obtained (or mass produced) without skills and managing, it does not represent scientific experimentation any more. Rather, it represents the way of a production system in modern factories after scientific research is finished."

5.3 Experimental factors and reproducibility

As we have seen, in cooking, we cannot get the same results by cooking in the same way when we use a different oven. According to the individual ovens, or the
containers used, the temperature and the time need to be adjusted slightly. This is the
same in scientific experiments. Keeping the condition constant includes not only the
settings of machines, but also “cleanliness”. The substances that S Lab members were
dealing with involved very delicate and sensitive considerations. For example, even
potassium and sodium in human perspiration, or iron in blood could influence the sample
that they were making; thus gloves were indispensable equipment in the lab. The sources
of contamination are not just from humans. When people share machines, they could
mutually contaminate each other’s samples with residues from the previous experiment
(by not using gloves, or, not using clean tweezers, etc.) When the temperature is
increased to several hundred or even a thousand degree Celsius, metal residue evaporates
and melts into the target sample; this unwanted substance then causes degradation of the
sample’s quality. When there are factors such as the ones described above while sharing
machines, social aspects of sharing a machine cannot be ignored. Thus in scientific
research, besides situated aspects, social aspects in the group work are very important.

When a lab member changes the settings on a machine, sometimes the results of
one or more other lab members cannot be reproduced. When the lab members conduct
experiments, they do not know all the factors involved in the experiments. The successful
results could even depend on luck sometimes. For example, one graduate student said
that if he used his friend’s machine (a shared lab machine but heavily used by his friend)
with organic matter, adhesion of residue on the wall of the chamber might contaminate
his friend’s future experiments. Thus even when his friend’s faster machine was free and
available, he refrained from using it and kept using his slower machine in order not to
ruin his friend’s data.

Other students told me that they all have three kinds of tweezers: the cleanest ones,
moderately clean ones, and another set for all other purposes. They must be washed
periodically, and not be touched directly by hands. When students used tweezers, they
used disposable gloves in order to maintain cleanliness. One student said, “Maybe we are
doing this just to feel better about it, but we do not know. Maybe it doesn’t matter, but
maybe it matters.” In one machine, in order to use chamber 2, chamber 1 had to be
removed. By removing and re-attaching it, the position was changed slightly over a
period of time. "This is unavoidable when you are sharing the same machine with the others" (Shimada, 2/24/2003). He also said "the cleanliness does not appear in numbers."

He also added, "Even if everybody uses clean tools (for example tweezers) in a clean manner (by wearing disposable gloves), if there is one person who uses dirty ones, all efforts become in vain." This shows how important it is for all the users to be sincere about keeping cleanliness, or following some part of a procedure methodically. He also said, "We cannot tell whether this person is doing it right or not unless we (actually) work together." This implies the importance of trust in the sharing of machines as well as keeping the conditions constant to reproduce the consistent results.

There was no "clean room" in this lab. Thus lab members had to do their best to

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16 Incidentally, I noticed the professor's favorite expression was "seijitsu (sincere, or sincerely)." In the early stage of my data collection, one IGS told me that he found this funny that the professor used the direct translation of this Japanese word (sincere, and sincerely) in his English sentences, which did not make much sense. I agreed with him then. It took me several years until I realized the meaning of trust or sincerity in the science world where objectivity, numbers, machines and materials seemed to represent their practice.

17 Clean room is a special room where the amount of dust is controlled. Micro or nano meter level work or products can be damaged by dust. Thus in companies or in rich labs dealing with nano scale materials, there are clean rooms.
fight against dust and other contamination (such as grease from fingers.) They were afraid of contamination because that would influence the data, and this is another factor, which they could not control. However, the way to maintain cleanliness depended on the kinds of machines, and it was not simple and straightforward. The results of experiments were under the influence of delicate and unknown factors, so that simply following procedures and instructions written in a manual would not necessarily produce the expected results. To obtain desired results from an experiment, experimenters need to have various types of know-how that are not written in experimental manuals.

The cooking examples I used earlier are about cooking as private practice, but if I need to work with others, I can relate to the Japanese students above. If I cook with other people, I do not want anyone to use my pancake frying pan for cooking fish, for example. Otherwise, my pancakes will be “contaminated” with fishy smell the next time I make them. I imagine professional chefs working in the same kitchen can easily relate to the science students’ comments above.

In short, the results of the experiments depend on various delicate or unknown
factors in scientific practices. Even if one follows the experimental manual, the same
results are not guaranteed, as shown above. In order to obtain certain experimental results,
there are varieties of know-how, which I will describe below.

5.4 Various kinds of know-how one cannot find in experimental manuals

In the case of cooking, there is much know-how necessary for cooking
successfully. Know-how is indispensable for the cooking practice, and it is no different
for scientific experiments. In this section, various types of know-how not written in
manuals will be introduced to illustrate what the situated knowledge of S Lab is like.

There is an adjustment screw in the AFM (Atomic Force Microscope) for
enlarging or shrinking images. If one uses too much force in turning it, it will break and
will not stop any more. When examining the characteristics (such as roughness) of the
sample's surface, if one does not use the probe (needle to check the roughness) properly,
the probe will break. One heavy user IGS told me that this is preventable, as it is caused
by carelessness. However, Fumiko said, "Learning it by practice is important (in science.)
That's how everybody learns. Students are paying tuition for that. It is a very good opportunity for learning for the students.” This disagreement about use is an example of how it cannot be in the manual. There is no fixed rule about how students should learn.

Another example is concerning the procedures of experiment. Five months after he enrolled in Japanese master’s program, a European IGS Max, was learning an experimental process from a Japanese student Ueda. They were melting the surface of a sample by heated acid. After few minutes, they had to rinse the acid off. Then they needed to dry it by oxygen. Max turned the valve too much, which let gas blow too hard. The sample blew out of a beaker Ueda was holding and it landed on the floor. When the sample landed on the floor, Ueda screamed “Ahhh!!!” Then laughed out of shock. He kept saying “Anbiliibaboo dana. (It’s unbelievable.)” and “Shinji rare nai! (I cannot believe this!)” He started the process the day before and this was the final step. Another Japanese student who was there asked Ueda “Mata 1:30 made? (Are you going to) work until 1:30 a.m. again?” Ueda replied “Atarimae jan! (Of course!)” The sample was contaminated, and that was the end of this 6-7 hour process. If Max had slowly let the
oxygen flow, then the sample could have been saved. A Japanese student told me a

similar case as that of Max. According to him, when using a kiln for baking a sample, the
effective technique was to open a door of a machine slowly rather than all at once. This

sort of a know-how is learned by practicing, just as learning in cooking practice. This

kind of things is not written in a manual but it is very important piece of knowledge.

Another example of using a machine in a situated way in this lab concerns the use

of an old machine. The machine’s LCD (display) was broken, so the user was following

the procedure by looking at three lamps. He could tell the changes of condition by the

pattern of the lighted lamps. At least in this case, the main user explained this to the

whole lab members before his graduation thus this know-how was passed down.

As illustrated above, in labs, there is much knowledge, which is not written in

manuals. This knowledge is produced locally in everyday practice, and much of it is

passed down through interactions in practice.
5.5 Social distribution of knowledge

The knowledge related to experiments is distributed in a lab. It is distributed among machines, manuals, graduate students who are heavy users, and students who write computer programs. The knowledge related to a specific research topic is also distributed. Students not only read academic papers, but they receive guidance from their seniors, faculty members, and their peers. That is the reason why it is quite unusual to have a single-authored paper in applied physics journals.

From attending lab meetings, it was clear that even the professor did not know all the details of the machines and research topics in the lab. He understood everything well, and guided research groups, which was not producing good results, by providing them with valuable suggestions. However, at times he would suggest raising or lowering the temperature or pressure and the experimenters would respond that it was beyond the machine’s capacity. In other cases, he suggested one way or another to improve research, but the suggestions were refuted by the experimenters. For example, Professor Suzuki suggested conducting a particular experiment with laser in lower temperature. A student
responded that conducting it with low temperature would not work. Instead the student
proposed an alternative way of using a heater, which produced higher temperature.

In this configuration, the knowledge related to experiments is widely distributed
and there is no single person, a master, who knows everything. If one cannot access these
resources, including the location and people, one cannot obtain the knowledge needed for
the experiments. Therefore, if there are no graduate students who take over one topic of
research, the know-how for the machine use will also die. This kind of management is not
successful all the time in this lab.

Lave & Wenger (1990) pointed out that “mastery resides not in the master but in
the organization of the community of practice of which the master is part” (p. 94). It can
be rephrased that mastery resides in the interplay among equipment, documents, and
social interaction in the lab community. A professor in a lab can be seen as a master in a
lab. However, he does not know everything. As described in Traweek (1988), a professor
does not have time to actually conduct experiments. He is often busy trying to raise
money from different funding sources, or busy with academic meetings and

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administrative jobs at their university. A lab cannot be competitive without necessary
equipment and chemicals, substances, and machines; thus raising money is a very
important role of a professor. Once he starts having more money, students and other lab
members can conduct competitive studies, and the professor will become more
well-known, and he then becomes busier still with academic society-related jobs. By
fulfilling the responsibility of a senior member of academic society, he becomes yet more
famous and it continues to get easier to raise more money. All this work not directly
related to research takes up his time. Although he knows what kind of research projects
members are working on, he does not necessarily know the details of the experiment and
the machines in his lab, (for example, up to how much pressure or temperature it can
create.) In the lab, I have also observed other faculty members (different group leaders)
asking students about machines or experiments. Students also asked faculty and other
students.

There is no master who knows everything about experiments in a lab. The
knowledge of experiments and other lab practice is distributed. A newcomer has to find
his way to access this distributed knowledge. Thus interaction among the lab members is indispensable in the lab to conduct experiments and the lack of interaction has serious consequences.

5.6 Social organization of machines

As mentioned in section 5.4 about the “various kinds of know-how one cannot find in experimental manuals,” lab members are very much concerned with contamination in the experimental process. One big source of contamination was experimenters themselves. Moreover, machines were shared inside as well as outside of a particular lab. That means that maintaining cleanliness in experimental conditions for consistency in data was a social issue beyond being an individual experimental matter, as in the example of sharing a frying pan. Because many people share one machine, maintenance and management is socially done. Therefore, not only scheduling, but also coordination is very important and serious work. This point will be expanded on in Chapter 6, the next chapter.
Since machines were shared in and sometimes beyond a lab, the maintenance and management was done socially. Scheduling and coordination was not a simple matter since experimenters needed to use several machines one after another, and each process takes a different amount of time. Also, again, they were working under the pressure of time. They had to finish the experiment in time for the next lab meeting, which was held in time for the next abstract deadline for a conference, or for the actual conference.

Machines were not free for use for anyone, even when they were not being used. The access to machines was limited socially because as we have seen, letting more people use them could cause contamination or even breakage.

Because of the centrality of machine access, Fumiko said that she would not go on the lab’s summer trip. Besides the fact that it was expensive for a self-supporting student like her, all the machines were free during that period. Usually, when she wanted to use more than two machines, she had to ask all the users, and even when it looked free, someone might say, “oh, yeah, I want to use it for another hour or so.” It was a cumbersome process to get access and she could not conduct her experiments smoothly.
For some part of the research process, her sample needed to be experimented on without interval, and having machines free meant that she could start any time and adjust her time accordingly.

One IGS in another department wanted to keep others away from his machine. He was a post-doctoral fellow and a new machine was bought upon his request for his research purpose, he said. He was annoyed by other students using “his” machine and breaking parts and messing up the setting regularly. He asked his professor to tell others not to touch “his” machine, but the professor said that he could not do that because the machine belonged to the lab. When I asked for a comment about this case, both Professor Suzuki and the S Lab research associate independently said, “One should use machines even by fighting” and that is what they did when they were students. This statement and the episode of the IGS above show severe competition for machine use. It does not happen all the time, but at busy times (for example, right before a conference) the issue of machine use could become a serious matter. A machine is not a mere physical entity that anyone can use whenever he wants to, once he becomes a part of a lab.
In a different department, yet another IGS told me that he could not access a
machine in his neighboring lab. He was told by his professor to use this machine in the
lab on the same floor. However, when he want to use this machine, nobody was willing to
help him there, and he could not use the machine. This may sound strange, but in fact the
social organization of machine access entails that even if a machine is free, a simple
request by a professor to let his student use the machine is not how to access it
successfully.

All these examples show that a machine is not just a physical entity. It is a social
system in actual scientific practice. The issue of access will be discussed in more detail in
the next chapter.

5.7 The language in lab practice

As we have seen thus far, scientific practice is situated and bricolage work. For
example, scientific experiments were not conducted under conditions where stable
machines were ready to be used and stable results could be guaranteed by following
experimental manuals. Like cooking, scientific experiments require creativity in using available tools and machines at hand in the given situation. Social interaction and language use must be the reflection of the situatedness of these practices, even though scientific language is commonly regarded as context independent, general and formal.

For example, teaching how to conduct an experiment or explaining how to use a machine is beyond the formal explanations of experimental manuals. Actually, they are highly context dependent, as shown in Jordan’s study (1987) described in Chapter 2.

Just like cooking, without artifacts such as machines or experimental practice, it is very difficult or impossible to deliver a detailed explanation in science. The explanation of experiments and machines are done in accordance with the situation in front of the actual machines, and with a constellation of other resources. For example, in his presentation in *Nihongo Kyooiku Gakkai*, Yanagimachi (2003) showed how an instructor (a professor) is depending on various resources, tools and equipment, and actions when he explains how to conduct an experiment to his Chinese graduate student. Thus Yanagimachi pointed out “In the communication in a lab, language is organically
connected to the movement of the people, special arrangements of artifacts, the way
artifacts are used, and eye gaze and gesture. Thus the difficulty of analyzing and
discussing linguistic data separated from other factors is implied.” In the data that
Yanagimachi presented, the professor told the Chinese graduate student that “she had
better wear (gloves)” and she went away to get gloves and came back; as she was putting
gloves on, then he continued the instruction. In this sequence, the utterance and response
was displayed and understood by the action of wearing gloves and movement from one
place to another. Yanagimachi said, “Thus a perspective is necessary to look not only at
the utterance of the participants, but also to position the linguistic code as one of the
various resources existing in a context.” In short, the instruction is impossible without
sharing various resources and contexts.

Scientific texts, journal articles and manuals can be also regarded as resources
utilized in situated practices. These artifacts make sense only when accompanied with the
actual use of tools and equipment and with know-how unwritten in texts. However, the
previous research on NA for language education has focused only on texts themselves
and has not examined how scientific texts, journal articles and manuals are used and in what kind of practice. My data as well as Yanagimachi’s data show that it is important and necessary to study language use embedded in practice.

Thus, in scientific practices, how to access to resources (machines and the experimental situation in this case) and how one can have an opportunity to interact after succeeding in accessing resources, are extremely important.

In this chapter, the daily practice of cooking and the scientific practice of experiments were compared, and then the social aspects of scientific practice were highlighted.

The next chapter will examine:

1. How the know-how of machine use and experimentation, which is not written in manuals, is socially distributed in a lab community.

2. The importance of access to this kind of socially distributed knowledge, and the necessity for members to build a social network.

3. How opportunities of interaction and the language use are organized and embedded in the daily practices of labs.
CHAPTER 6
SOCIAL ORGANIZATION OF ACCESS TO MACHINES IN THE LAB

“I don't even know which group I belong to.” (Karl)

6.1. Introduction

In this chapter, I will describe learning as ways of participation in a CoP. Here, I will show three things. First of all, I will illustrate how IGSs are able or not able to access the machines necessary for research, by analyzing in detail how two European master’s level IGSs, Karl and Max, were able or unable to access machines. While doing so, I will demonstrate how lab members’ access to machines is socially organized by describing who controls members’ access to machines and how access is prevented or facilitated. How one is able to access machines or not represents symbolically the member’s way of participation in the lab practice. Second, I will show how participation in a CoP is accomplished and organized through participation in multi-layered activities and situations. Third, I will show how an institutional framework could be a structuring
resource for participation in a CoP.

A way of participation serves as a framework for discourse among members in the lab. In other words, focusing on an IGS’s way of participation involves studying an IGS’s opportunities for second language learning and use. In short, I will argue for studying second language learning and use indirectly by focusing on a way of an IGS’s participation rather than by directly studying language data. The research on opportunities for second language learning and use in everyday practices is useful for a NA of IGSs. After description and analysis of my ethnographic data, I will relate the findings to NA, in terms of possible innovations in the Japanese language program serving these IGSs.

In the following sections, first of all, I describe the background of the lab, and then I illustrate how problems occurred and relate these problems to ways of participation in the CoP.
Background of an experimental science lab

In an experimental science lab, access to machines and equipment is very important for lab members since one cannot conduct research without accessing and dealing with machines and equipment, as I described in the previous chapter on situated practices in a lab. Some of the machines and equipment are very delicate and have to be handled with care. Furthermore, operation of machines is complicated and descriptions in manuals are often not detailed enough to operate machines. Manuals are not written for the very lab-specific use. Thus lab members make manuals for their specific use.

However, one cannot describe all the details about how to operate these machines. Members in the lab help each other and learn from one another when they use machines. Thus, the knowledge of how to operate delicate and complicated machines is socially distributed. Also, since machines are shared in a lab, the use of machines is negotiated in labs among users. This social management of machines is important in order to make lab members treat machines properly.
6.2 The cases of access in S Lab

The following cases will illustrate how the use of machines and equipment in labs is socially arranged.

6.2.1 Karl’s Case: Failure to access the machine

Karl arrived in fall of 1999 as an exchange student. For a while Karl was working strange hours, like 4:00 to 8:00 in the morning every day. The other students would also work well past midnight, but only when they were very busy, not every day. Karl explained that the reason for working strange hours was because he needed to change an attachment on the machine he was using. While he changed the parts, others could not use the machine, so he did it at strange hours when no one was around.

When I said to Karl that such behavior was very considerate of him, he replied “I call it survival” (12/9/1999). A month later, Karl was working in two shifts, either coming in very early, or very late (1/28/2000). His schedule was seen as odd by some Japanese students. One Japanese said that Karl’s behavior seemed as if he avoided contact with lab
members and he was anti-social. In fact, avoiding the need for communication was part
of Karl’s motivation for working at such odd hours.

Some Japanese students were unhappy with Karl’s use of the machine. Toshi, who
was the main user of the machine and who took responsibility for maintaining the
machine, made a schedule for machine use that made Karl’s access to the machine almost
impossible. Much later, Karl said to me “It was a fake schedule Toshi made. The machine
was available (for Karl) only on Sundays” (2/18/2001). Karl was upset by this.
Eventually, he decided to conduct his experiments in another institute where he did not
have to share a machine with anyone even though he had to spend several hours
commuting every day. In that institute, he only used the machine and seldom had contact
with others (full-time specialists or other users) there.

I knew that Toshi was not very fond of English speakers, including me. Thus,
when I heard from Karl that Toshi set up a schedule for machine use that made Karl’s
access to the machine almost impossible, it seemed to Karl that Toshi was trying to be
mean and prevent him from using the machine. In fact, Karl was kept away from the
machine. This was a symbolic incident where Karl could not access machines, which indicates a critical part of how he could not participate in the CoP of the lab with regard to access to a particular machine.

6.2.2 Toshi’s account

Toshi’s conduct seemed like bullying. However, later interviews with Toshi and other Japanese students revealed different reasoning than simply personal dislike. Toshi told me the importance of “trust”. For him, the machine was his treasure, “tora no ko no soochi [my treasure machine].” Thus he did not want someone he could not trust to use his machine.

If we are using the same machine, and if an international student breaks it, then I have to contact the maker of the machine, or try to fix as much as I can by myself. This will not make me feel good. [Whether this person is an international student or Japanese,] I do not want people who are not familiar with my machine to touch it. (Toshi, 3/12/2001)
Other students using the same delicate machine also expressed the same opinion independently: they do not want unskilled or untrustworthy people to use the machine.

Once, Karl changed the angle of the mirror in the machine. Toshi was upset.

However, Karl believed this change in angle would improve the research. Karl told me that he had used the same machine in his lab back in Europe and he had achieved better focus (thus obtaining better results) by changing the angle. He continued that if one could not reproduce the same results under the same conditions, it is not science. For him, changing the angle was not just for his own purpose but for the lab and for better science.

However, Toshi did not think so. Karl’s view of scientific experimentation appears notably different from other researchers’ view, as I described in Chapter 5.

Since Karl could not speak Japanese, another IGS named Max interpreted at times like this when Karl could not communicate with the Japanese-speaking students.

Nevertheless, the problem was not solved and both sides felt uncomfortable about this issue. This episode showed that the problem was beyond that of language.

The following interview with a Japanese student, Tamada, along with my
observations, also revealed how members in the lab were very careful not to contaminate another member’s experimental data.

Tamada’s machine was old and very slow, so it took four hours to complete one part of his experiment. His friend Ida was using a newer and faster machine of the same kind, so it took 1.5 hours. Thus Ida could do his experiments many times a day, whereas Tamada could do them three times at most. However, he would not use Ida’s machine even when it was free, for fear of affecting Ida’s results.

If someone changes a setting, the regular user of that machine might not be able to reproduce the same result as before. Thus when someone asked Tamada to let him use new and different material, Tamada wanted to refuse if he could. After a new material has been used, there might be some residue in the chamber of the machine. Maybe this residue would influence his experiment, maybe not. Tamada sometimes washed the wall of the chamber with chemicals to rinse off the unwanted substance, but maybe having this extra substance was good. (Tamada, 5/2/2001) This interview shows the fragility of data the lab members are dealing with. People who are outside the scientific community tend
to believe that science is very solid and it is easy to reproduce the same result in the same experimental conditions. However, it is well known among people who practice experimental science that even in the same lab, with the same settings, consistent results of a delicate experiment cannot be obtained easily, as I elaborated on in Chapter 5.

Tamada also mentioned “trust” in the same interview. He and Ida were good friends and Tamada could let Ida use his machine to a certain extent, because he trusted him. Ida would not use a substance that would affect Tamada’s data. During interviews, the term “trust” was utilized by Japanese members when a member referred to another member who was very careful not to contaminate the data of colleagues.

Another important fact in the lab is that the data is cumulative. The members systematically design research and change parameter settings such as temperature, gas pressure, and laser power and distance. If someone interrupts this long process of conducting series of experiments, and changes some setting, all the data from the past could be ruined. It might be data that one’s sempai (senior) had started more than a year before with extensive hours of engagement in the repeated process of experiments.
Tamada described his perception of the use of machines by IGSs as follows:

They do not follow the details of the rules. Even if they are not supposed to turn the *neji* (screw) after a certain point, they do. I warned them several times, but it was turned too much. The machine might easily have broken. For example, take the minute adjustment of AFM (atomic force magnifier). Once you turn it too much, the screw would become (permanently) loose (thus broken forever). It is broken now.  
(Tamada, 5/2/2001)

One student said about the use of machines, “It is impossible that everyone has the same level of mastery” (Shimada, 2/25/2003). This statement shows the distribution of knowledge.

We are dealing with the micro (meter) and nano (meter) world. Thus it is important to keep clean. We each have different tweezers for different purposes. The ones for the cleanest use, ones for normal clean use, and ones for miscellaneous use. We wash them regularly, and use *sakuramen* (a product name for disposable plastic gloves for scientists). Even if everyone else uses clean tweezers cleanly, if there is just one person who does not, it’s no good.  
(Shimada, 2/25/2003)

This means that the level of cleanliness is maintained through everyone’s daily effort and cooperation. Thus, the lab member’s idea of “trust” has very practical implications and importance for their everyday practice. The use of *sakuramen* and
cleanliness were mentioned by another student from a nearby lab in an interview that I conducted in the year 2000. This student also clearly said that nationality did not matter.

Toshi said that Japanese students knew where other Japanese students were. Thus if someone’s experiment ended early, then Toshi could adjust the schedule because he knew how to contact the next student, and they could talk about problems of machine use. On the other hand, Toshi said that he had no idea where IGSs were. In the case of Karl, Toshi did not even know why this person was in the lab, what kind of research he was conducting, or how long he was going to stay in the lab\textsuperscript{18}. Other Japanese students also expressed similar things (such as where IGSs spent their time) independently of what Toshi said.

\textsuperscript{18} Before Karl arrived in Japan, Professor Suzuki sent an e-mail message introducing Karl to everyone. When Karl arrived in S Lab, there was a meeting called “tea party” where each student presented his research. Karl was introduced officially to everyone and he presented as well. When I asked Toshi about this meeting, he said he did remember the meeting. However, these official introductions alone were obviously not enough.
6.2.3 Analysis of Karl’s case

Karl’s case illustrates how machines are socially organized in labs. In experimental science labs, most notably, lab members work with complex and delicate machines. Since all members share the machines in the lab, they must effectively negotiate their schedules. For some experiments, the experimenter needs to change the settings of a machine (degree of temperature, and/or pressure, or length of time, for example) or a type of gas (nitrogen or oxygen, for example) and other substances they use. Japanese students did not want other users to change the machine settings, because someone’s data could be ruined in the process. Toshi not only used the machine heavily, but he also did the maintenance of the machine and made a schedule of use as a “gatekeeper” for the machine access. Ida and other students told me that a heavy user of a particular machine also “kanri suru (manages)” and fixes that machine. (Ida, 2/21/2002)

According to the Japanese students, it is very important for them to share machines only with someone whom they can trust, i.e. someone who is considerate enough not to influence or ruin other people’s data.
6.2.4 Black box

A black box is “a device which performs some useful function, but whose internal mechanisms are not available to inspection” (Wenger, 1990, p. 96). Wenger calls the opposite device a “glass box.” What makes a black box a black box is the inaccessibility to its mechanism or content, whereas a glass box is transparent and we can see the mechanism and whatever else is inside. By applying this analogy, according to Wenger, a black-box is an artifact whose meaning is not transparent for those who cannot access the activity in which that artifact is utilized. In the case of Karl, the machine was a black-box for him. This is because he could not access the machine and the social networks around the machine.

At the same time, the reason why Karl could not access the machine is due to his way of understanding the cultural meaning of the machine. He thought that the machine was stable even though he changed the experimental conditions considerably. That was quite different from Toshi’s and the other members’ way of understanding the machine.
From the viewpoint of Toshi, Karl did not understand the delicateness of machine. Thus, Karl’s way of understanding the cultural meaning of the machine prevented him from accessing the machine, and while he could not access the machine he could not have opportunities to see the different cultural meaning of the machine within lab activities.

Karl’s trouble with access to the machine is probably an exceptional case in the lab; however, because of its exceptionality, it illustrates how access to machines is socially organized. If no one had the trouble Karl experienced, how access to machines is organized would not have become visible.

6.2.5 Successful access to machines: Max’s case

Another IGS in the lab, Max, was successful in accessing the machines. Max knew where all the machines were, even though machines were in many different places on campus and even in different institutions off campus. How was it possible? As I mentioned in Chapter 5, knowing what kinds of machines are available and where they are is a very important resource in lab life. This is because the type of research possible to
conduct is restricted by the kinds of machines available in the lab.

What helped Max’s access to machines was an informal network of master’s level students. This informal network in which various kinds of information was exchanged outside of classes was formed through attending classes in the master course and participating in the activities organized by the lab, such as the summer trip. For example, by attending required master’s classes, Max had opportunities to ask about class-related issues after classes or at lunch time, such as whether there was homework or not, and when the deadline for the final paper was. At first, he was not really welcomed, it seemed, but eventually, Japanese students started counting on him for certain homework, or even in examination situations, as I will describe in Chapter 8.

Further, Max was actively involved in organizing the lab’s formal seasonal events. It is because he was a first year master’s student and in this lab, traditionally, new master course students would be allocated the role of organizer of lab events. He was naturally allocated the role of one of the organizers for the lab events such as the picnic and the summer trip. Max was involved in the planning of the summer trip even before going on
the actual trip.

When Max went on the summer trip, Peter, a Ph.D. student in S Lab, said that going was a stupid thing because it was a waste of time and money. Peter enrolled in the doctoral program a year before Max started and he had been to the summer trip in the previous year. After Max came back from the trip, Peter said, “He is now the center. He knows how to use apparatus!” (8/27/1999) Peter continued how he used not to think highly of Max eating lunch and dinner with Japanese students, but he could see that it was a great idea. Max knew where machines were, and what kinds of machines were available four months after (i.e. by July) he enrolled in the master’s program by virtue of being with Japanese student for extensive time. Peter said that it took him one year to find out where machines were. He also told me that Max and he were using an experimental method applying a particular chemical. Max knew how to conduct this experiment, but he did not (8/30/1999). Even though Peter knew much more when Max first arrived S Lab, Max clearly had more access to the lab’s vital information compared with Peter a year before.
Unlike Max, Peter came to the lab as a doctoral course student and he did not attend classes and did not get involved in the organization of events such as summer trip. For Peter, without becoming deeply involved, the summer trip was a trying three-day experience of merely observing what Japanese were like in a group at the beach.

Peter was impressed that Max came to know very quickly where machines were and how to use them. Through his informal first year M.S. (master of science) students’ network, Max could ask his master course colleagues about where machines were and how to use machines. Through participating in both in formal and informal activities such as attending master course classes and getting involved in the organization of the summer trip in the lab, his access to machines became possible.

6.2.6 Karl’s case revisited

In this section, I will examine the status of Karl with an eye toward explaining why he could not access machines. Karl started taking Japanese classes shortly after his arrival in Japan. He was eager to learn Japanese but he could not attend every class
because of his experiment schedule. The textbook was written in *kana*, Japanese writing, and Karl soon realized that he was the only illiterate student in the class, which made him begin to feel that he was wasting his time. He could not memorize all the *kana* characters.

Moreover, *kanji* (Chinese characters) appeared in the textbook even before he could master *kana*. He said he only wanted to learn conversation, but he needed to be able to read Japanese to a certain extent because the conversation textbooks used in class was written in Japanese.

He wanted to study Japanese, but he could not continue. On the other hand, for many Japanese students in this lab, communicating in English was painful. As one of them explained about his difficulty in communicating with IGSs, “I have to communicate in my lower than junior high school level English.”

Karl told me about the importance of human relationships in the lab. It is very important for members of a lab to work in a group in science in general, and S Lab was not an exception. After almost 5 months into his stay in Japan, Karl told me jokingly, “I don't even know which group I belong to.” This complemented with what Japanese
students said about Karl; they did not know why he was in the lab, what he was doing, or, how long he would be there. Karl was not happy that he did not have any Japanese friends in the lab, but he did not participate in daily and seasonal events.

Not only Peter, but also several other IGSs from other labs have told me that they feel it is a waste of time and money to attend Japanese drinking parties or lab trips. Besides being expensive, Japanese drinking parties and lab trips are boring because IGSs do not understand what Japanese are talking or laughing about. Meal gatherings are also painful for IGSs, because of their time constraints and the language barrier. These perceptions were certainly true in the case of Karl. One Japanese student said that the IGSs who fail to participate in drinking or meal gatherings are not liked, because Japanese students feel that these IGS only come to talk to them when they are in trouble.

6.2.7 Language alone wouldn't solve the problem

An episode of Max, the trusted interpreter, not being able to fix Karl and Toshi’s problem clearly shows that language by itself does not solve the access problem. When
Karl could not access the machine in the lab, Max helped him as a Japanese-English interpreter to negotiate use of the machine with Toshi. In this context, Max was working as an interpreter. However, this attempt was not successful. This episode shows that language alone could not enable Karl to access the machine. The problem can also be seen as a larger one concerning ways of participating in this CoP. Karl’s failure at machine access itself relates to his non-participation in the CoP. We should also consider the fact that Karl’s opportunities for interaction with other (Japanese) members of the CoP were extremely limited. He experienced disappointment at both his Japanese class and the level of Japanese students’ English, and subsequently withdrew himself from engagement in many interactions. Thus, Karl had only minimal opportunities that might enable him to participate in the CoP.

On the other hand, Max had many opportunities to interact with lab members toward organizing his participation in the CoP. Max’s improvement in Japanese is closely related to his way of participation in the CoP. Max could access the machines not only through his Japanese ability but also by his way of participation.
6.2.8 Analysis: Comparison of two cases

In this section, I will summarize the differences in the ways of participation in the CoP between Karl and Max. The table below sums up the activities of M.S. students in the lab. The activities are composed of academic and non-academic activities, and “formal activities” (organized by the institution; the university and the lab), and “informal activities” (led by students themselves.) Thus, the activities are classified into four categories as shown in the table.
Table 5. Activities of the first year master’s students
(*Shaded area marks Karl’s participation)

<table>
<thead>
<tr>
<th>Activities</th>
<th>Academic</th>
<th>Non-academic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formal</strong></td>
<td>Classes</td>
<td>Seasonal lab events</td>
</tr>
<tr>
<td>(Institution-initiated)</td>
<td>Periodic lab meetings</td>
<td>Spring welcome party</td>
</tr>
<tr>
<td></td>
<td>Conferences</td>
<td>Summer retreat</td>
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<td></td>
<td></td>
<td>Fall hike/BBQ</td>
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<tr>
<td></td>
<td></td>
<td>Year-end lab clean-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year-end party</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Farewell party</td>
</tr>
<tr>
<td><strong>Informal</strong></td>
<td>Research-related</td>
<td>Lunch/dinner gatherings</td>
</tr>
<tr>
<td>(Student-initiated)</td>
<td>Read journals</td>
<td>Chat in the lab</td>
</tr>
<tr>
<td></td>
<td>Make samples</td>
<td>Smoke together</td>
</tr>
<tr>
<td></td>
<td>Measure samples</td>
<td>Watch TV</td>
</tr>
<tr>
<td></td>
<td>Use computers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Share artifacts</td>
<td></td>
</tr>
<tr>
<td>Classes</td>
<td>Attend the same classes</td>
<td>Parties without faculty</td>
</tr>
<tr>
<td></td>
<td>Sit together</td>
<td>Organize</td>
</tr>
<tr>
<td></td>
<td>Collaborate on homework</td>
<td>Participate</td>
</tr>
<tr>
<td></td>
<td>Study together before exams</td>
<td></td>
</tr>
<tr>
<td>Student-run study sessions</td>
<td>Organize</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participate</td>
<td></td>
</tr>
</tbody>
</table>
Among all the activities listed above, Karl practiced only academic activities: periodic lab meetings and conferences (academic formal), and research-related activity (academic informal). On the other hand, Max participated in all activities in the table. Max, by virtue of being a student in the master course program, incidentally participated in various activities in the institutional setting. For example, he had to attend classes as a formal academic activity. Max and his peers had opportunities to help each other to finish homework, an informal academic activity.

Furthermore, Max was naturally allocated the role of one of the organizers for the lab events such as a picnic and summer trip, because of his position as a new master course student in the lab.

In this way, Max could have many opportunities to interact with his Japanese peers and, as a result, he could access machines. This is how he could know the locations of various machines and types of equipment and know what kind of research could be conducted in the lab. Max could get to know the details of how to deal with machines and equipment far beyond the information provided in machine manuals. These are vital
resources for students to conduct experiments, and to practice science. In short, Max could access the practices of the lab in which machines and equipment were utilized. This case highlights how informal and formal activities are complementary.

Since Karl, unlike Max, was an exchange student, and not an official master course student at this Japanese university, he did not have to attend classes (a formal academic activity), nor did he have to participate in preparation for lab events (informal non-academic activity), which was perceived as an extra chore by all the lab members. Consequently, Karl and the Japanese students did not have any chances to get to know each other, and Karl failed to win the trust that was necessary for access to the machine and other resources of the lab. Although they started in a similar situation of not being able to access machines at the beginning of their membership in the CoP, Karl and Max’s ways of participation and their trajectories became quite different in the end.

Karl’s non-participation made the boundary visible between him and the whole lab CoP. Max, in comparison, did what he thought was expected of him and eventually had more and more contact with other members. This also meant access to the machines
and increased opportunity to learn and use Japanese.

These contrasting cases illustrate how formal and informal activities (as shown in Table 5) or, in Brown & Duguid's (1991) term, canonical and noncanonical practices, are so deeply related to each other as to be inseparable. In Brown & Duguid's workplace study, canonical practices are practices prepared institutionally by a company, for example, description of knowledge in formal learning such as a training course or training manual. Noncanonical practices are practices not institutionally described, for example, a card game situation among workers, which includes the informal sharing of knowledge.

Brown & Duguid (1991) distinguished canonical and noncanonical practices along with referring to Orr's (1990) workplace research on repair technicians of copiers. Their terms, canonical and noncanonical practices are related to formal and informal activities I described above. In Brown & Duguid's paper, canonical practices are practices prepared institutionally by a company, for example, engaging in training program with using training manuals. Noncanonical practices are practices not
institutionally described, for example, a card game situation where technicians interacted
with each other. These situations include the informal sharing of knowledge. I could
observe cases similar to the card game situation in S Lab.

However, Brown and Duguid do not point out that noncanonical practices are
constituted dependent on the ways that canonical practice and the canonical community
are organized. What I showed here is that these contrasting cases illustrate how formal
and informal activities, or, in Brown & Duguid’s term, canonical and noncanonical
practices, as shown in Table 5, are so deeply related to each other as to be inseparable.

With many parallels to the above cases, Wenger (1990) analyzes the reason why
newcomers to the insurance company Alinsu felt great difficulties. Even though the
newcomers formed a network among themselves in training class, they were placed in
different divisions. Thus they could not maintain their network on the floor. Moreover, on
the floor, other claims processors were constantly feeling pressured, and in addition, they
did not recognize the need to help newcomers; thus newcomers were isolated and many
left the job in a matter of few weeks. This case shows that although the training class was
there for a different purpose (training), it also created the opportunity for newcomers to form an informal network. The case of Max is opposite to the case of the claims processors. In S Lab, the informal network formed in classes was continuously maintained and helped Max's access to machines and other resources on the floor (i.e. the experimental rooms.)

Regarding informal occasions, Wenger (1990) argues that for the claim processors in an insurance company, the daily work and participation in informal rituals (such as the celebration of someone's birthday or exchange of Christmas presents) are complementary and they form the texture of the practice as a whole. Not only is participation in informal activities complementary to formal activities, but participation in informal activities also supports the formal activities (e.g., facilitates access to machines to conduct research).

In short, the case above illustrates that participation in a CoP, such as conducting experiments in a graduate science lab, is not merely participation in a single activity. Participation is accomplished by interacting with community members in various interwoven activities that may or may not appear on the surface to be related to the
In this chapter, I showed three things. First of all, I illustrated how access to lab practices is socially organized, by analyzing how two IGSs were either more or less able to access machines. I thus demonstrated specifically how the access to machines in labs is socially organized. This matter of access became visible by focusing on contrasting cases of two IGSs. Secondly, I showed how their trajectories of participation (crossing or moving among various formal and informal activities) were different and how these differences facilitated or restricted their access to scientific resources. Finally, I showed how an institutional framework (in this case, the master’s program) could be a structuring

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19 Readers who are not familiar with my participants may tend to believe that my findings reveal sharp differences in personality between Karl and Max, with Karl being the introvert and Max the extrovert. In fact, from my observations, I found Max to be the introvert and Karl the extrovert. Student members of S Lab confirmed this observation about Max. Since Karl did not have much contact with these students, English speakers including Fumiko who worked with him closely on repairing a machine, confirmed that Karl was an extrovert. Strictly speaking, from the perspective of situated learning theory, assuming fixed personality beyond situations is problematic. The conventional notion of “personality” might also be fruitfully analyzed in relation to an individual’s ways of participation in various situations and activities.
resource for participation in a CoP as shown in the case of Max. In the following section, I will discuss design of learning environment based on these findings.

6.3 Designing learning environments

My research does not focus on the second language acquisition or use of IGSs. Rather, I have presented how IGSs in the lab participated or failed to participate in the CoP. As a result, I found that ways of participating in the CoP are critical for learning the second language. Indeed, as Max’s case shows, ways of participating in the CoP provide many opportunities to learn a second language even though these opportunities are not arranged for language learning. On the other hand, non-participation in the CoP makes opportunities for second language learning minimal, as Karl’s case shows. This pattern is consistent with other cases to be shown later.

Previous research on SLA has focused on the linguistic aspects of language, and has not paid much attention to how opportunities for second language use are socially organized. I demonstrated how opportunities for second language use are socially
organized by applying the theoretical framework of Wenger, which formulates ways of participation in a CoP. My research is oriented toward design of the learning environment for second language learning. From this perspective, it is extremely important to design a learning environment in a way that promotes opportunities for second language use through participating in various activities in a CoP. Thus, design of the learning environment for second language learning is synonymous with the design of opportunities for participation for IGSs. The comparison of Karl and Max provided us with concrete ideas for designing participation for IGSs. For example, Max's participation in the CoP was not intentionally designed. Rather, his participation in the CoP was incidentally organized. However, the case of Max provided us with concrete ideas of how participation of IGSs should be designed.

This research direction, focusing on design of learning environment, has just started in the field of SLA. However, the approaches of situated learning and design of learning environment seem promising in providing us with practical solutions for various problems concerning second language learning and use as I will outline in Chapter 9.
In this chapter, I illustrated how participation in a CoP is composed of participation in varying and mutually related activities. In the next chapter, I will examine participation more concretely and in detail in order to clarify enabling conditions for participation for IGSs.
“It is important to ask what someone is doing when you have free time in the middle of the night (while waiting for an experiment to finish). This seemingly useless interaction is very important” (Tateda, 3/15/2000).

According to situated learning theory, participation in a CoP is composed of participation in various mutually related activities. Actually, as shown in the previous chapter, the access to machines was accomplished by participation in a variety of activities (formal and informal, academic and non-academic), which are mutually interwoven. However, formal and informal, academic and non-academic activities are merely the institutionalized joint enterprises of the lab. In reality, even within these institutionalized activities, diverse occasions are organized.

For example, in the lab, clearly different scenes (backstage) were organized when faculty members were not around. Moreover, these kinds of situations were not open to everyone who belonged to the lab. In order to examine participation more concretely and
in detail, ways in which these various situations were organized need to be studied concretely. With regard to IGSs, in order to clarify enabling conditions for participation, IGSs’ participation in various situations must be studied.

However, situated learning theory describes activities within a relatively broad framework, and falls short of offering a framework to clarify how various situations are organized. Goffman’s notion of frontstage and backstage, on the other hand, offers a perspective to describe concretely ways of organization of these various situations.

Moreover, Goffman’s notions shed light on how the organization of various situations cannot be separated from power relations. For example, people in positions of lesser power often organize their backstage where people in power (i.e., those who are the main characters on the frontstage like a customer or a boss) cannot see. Participation in a CoP is also organized and influenced by power relations realized through the activities of the CoP. However, situated learning theory has not addressed the issue of power relations. These notions of Goffman’s can compensate for this shortcoming of situated learning.
theory.

In this chapter, I will use Goffman’s perspective in order to examine IGSs’ ways of participation concretely (as opposed to abstractly), and events organized in the lab will be examined in more detail.

7.1 Goffman’s notion of frontstage and backstage

One of the things I noticed in the lab was that graduate students behaved differently depending on the presence of faculty members. These situations were marked differently according to time, space, and the words or registers used. This reminded me of Goffman’s (1959) discussion of frontstage and backstage.

Goffman (1959, pp. 112-113) cites de Beauvoir’s (1953) description of women when men are absent. When men are around, it is a frontstage for women and when they are not around, it is the women’s backstage. Backstage, performers are able to relax and prepare for the frontstage performance. Or in the case of Goffman’s Shetland Hotel (1959), the workers’ behavior was very different in the kitchen, which is their backstage,
and in front of guests, which is their frontstage. The guests are the audience and the workers are the performers, in this case. In the lab, it can be said that the faculty members are the audience, and the students can be seen as performers from the students’ point of view. The following examples illustrate this point.

**Case 1. When faculty members are not around: The time**

When faculty members are not around, organization of the social space in the lab shifts, or when they are around it also shifts. In this university, associate professors and research associates as well as technicians shared office space in the labs with students. After the faculty members went home, students turned on the TV and started watching baseball games, or movies. Student interaction was livelier when faculty members were not there. It was at these times that the students could relax and also find spaces to share their research interests.

Students often said that they did not understand what others were studying. Of course they had some idea, but because of the specific nature of their respective research
and the formal nature of interaction during the day, they could not fully understand the research of other members. However, the backstage talk that occurred after hours was a vital source of information concerning their research, and also concerning who they were besides their academic status (such as M1 or M2), or their categorical labels such as which research group they belonged to. One student said, “It is important to ask what someone is doing when you have free time in the middle of the night (while waiting for an experiment to finish). This seemingly useless interaction is very important” (Tateda, 3/15/2000). Because this was the time to get to know not only other people’s research but also to hear about other research-related matters, such as the machines and the bricolage of others, and thus it was time to share their repertoire.

Case 2 Honda-san’s room: The space

Case 1 was an example of the backstage being organized after a certain time of the day (or on a weekend.) The following is the case of how certain spaces construct the backstage. This case is similar to Goffman’s (1959) description of Shetland Hotel, where
certain spaces are constructed as a backstage.

One of the faculty members, Honda, was a technician. Although he did not have to teach any classes, and therefore he did not have to evaluate any students, he was called Honda "sensei (respected title for teachers)," or Honda "san (Mr., in this case, showing solidarity)." He was well respected for his extensive knowledge about machines and skills in using machines, among his other abilities. He was the oldest member of the lab, and thus had known Professor Suzuki and the other three faculty members since they were students. He had helped these faculty members when they were students, as well as after they became faculty members. Thus he was respected by everyone in the lab. His room was called "Honda san beya (Mr. Honda’s room)" and it was where many students took breaks. He joined students when they were making noise and having fun, whereas some other faculty members would tell them to quiet down when they were too noisy. Students told me that they go to Honda san beya together after eating a meal together, and before and after classes. They would discuss such issues as how to solve the homework problems (as well as talking about things irrelevant to science.) (Toshi,
Honda san beya was also called the "tabako beya (smoking room)" because smoking was allowed there. Honda was a smoker and he liked to talk to students and teach students not just about physics, but also about a wide range of topics, such as politics, history, and food. Students who smoked went to this room often to relax and talk to the other students. Some students did not go to this room because it was noisy and smoky. Max started coming to this room after he started smoking in fall of the second year of the master's program. At the end of each school year, because of graduating students, some desks become free. Eventually, he left the main lab and moved in to this room.

Students came to this room to ask Mr. Honda for suggestions and tips concerning their experiments. Other students who were around would join the discussion about the ways to solve the problem and/or mechanism behind it. Students who were not actively involved in the conversation would be listening to it.

There also was a TV and sports newspaper in this room. Japanese students
watched sports (e.g., baseball or soccer) or movies on TV after faculty returned home, or on weekends. As in many other labs, easy-to-read weekly comic magazines could also be seen. Students read them during waiting times of their experiments (once experiments started, they had to wait until the experiments were over), or when they became tired of studying. Other labs I observed had extra room where students could hang around, drink coffee, make instant noodles, smoke, or have small meetings. Max watched TV with his Japanese peers but I heard that other IGSs did not. One day, I saw Max asking about a character in a popular Japanese drama. They were also discussing about whether the main character was a typical young Japanese woman. This kind of talk about TV, or about Japanese culture would sometimes lead to talk about physics as well.

**Time and space, frontstage and backstage**

Honda’s room was a backstage where students relaxed in between their frontstage of classes and presentations at the lab meetings or conferences. They prepared for the frontstage performance by doing homework or making PowerPoint slides in *Honda san*
beya. It was a space for backstage activities. The backstage was also organized
temporally. After the faculty had left, the students’ relaxed.

Even though Honda held a faculty position, he served to connect the frontstage
and backstage. The fact that he was not in the position of evaluating students formally put
him in this position. Students respected him and when they had troubles, which they
could not solve amongst themselves, he was the one whom they could count on. Because
he is a faculty member without research responsibility, he accumulated knowledge in the
lab. Thus he was the embodiment of the history of the lab’s shared knowledge: he knew
the lab’s stories, historical events, concepts, tools, and artifacts. He and the students were
mutually engaged in backstage and community maintenance, as well as engaged in the
lab’s scientific practice.

Case 3. Mimicking and ridiculing faculty during a summer trip

Frontstage and backstage behavior was also observed in places other than in
Honda’s room. Summer or winter trips are a common activity in science labs, and I had a
chance to go on the summer trip of another lab. Cases of both frontstage and backstage behavior could be seen during this trip. For example, the dinner party on the first night with faculty members was mainly a formal, frontstage situation. The seats were arranged such that the faculty members sat in the front of the room, called *kamiza* (literally the upper seats, the seat positions reserved for persons with higher status) area. Students sat with members conducting similar research or those of the same status (first year master’s students, for example.) The dinner started with the professor’s speech. After this official dinner, students got together in one of the students’ rooms and continued drinking without faculty members. Students would report interactions they had with faculty members, and tell others how silly they thought the faculty members were, and other members would laugh about it together, and drink more. They also shared descriptions of how they were treated or what they were told by faculty members, and took turns mimicking them.

Similar examples are reported in Goffman (1959) in service encounters and in the kitchen area of Shetland Hotel. Workers mock customers and behave differently when customers are not around. As characteristics of backstage, Goffman lists: “reciprocal first-naming,
co-operative decision-making, profanity, open sexual remarks, elaborate griping, smoking, rough informal dress, “sloppy” sitting and standing posture, use of dialect or sub-standard speech, mumbling and shouting, playful aggressivity and “kidding,” inconsiderateness for the other in minor but potentially symbolic acts, minor physical self-involvements such as humming, whistling, chewing nibbling, belching, and flatulence” (p. 128). Most of the description fits the behavior seen in private spaces shared by students during the lab summer trip.

Goffman (1959) points out that the bad-mouthing in the backstage has the function of maintaining the members’ solidarity. In the case of a lab, bad-mouthing of faculty members or other people in powerful positions can be interpreted as a reconfirmation of their membership and the social display of camaraderie. In other words, students were creating a sub-community, with a relatively different position from faculty within S Lab, by constituting a backstage.

This frontstage/backstage behavior and organization of space cannot be separated from the power relations of the CoP. Whether it is a hotel or a lab, the social relationships
in the frontstage are not symmetrical. Workers obey customers and provide service, and
students obey faculty members and work for them, as they refer to a professor as a
“boss,” or even “God.” In response to the social relationships in the frontstage, the
backstage behavior of hotel workers or students is performed. Thus, the
frontstage/backstage contrast was organized within asymmetrical social power relations.

It can be said that the participation as a graduate student in a lab CoP is
constructed by participation in the dual context of frontstage and backstage. Becoming a
member in a lab CoP includes participation in the backstage as well. In other words,
participation means participating in the social organization where power relations are
constructed, rather than participating in non-hierarchical organizational structure. In
situated learning theory, little discussion is devoted to power relations. However, the
description and discussion of frontstage/backstage behavior helps illuminate the power
relations in a concrete manner.

Related cases are reported by Østerlund (1996). According to Østerlund,
salespeople often move between business talk and informal conversation. For example, a

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salesperson called Carol would manage to interweave small conversations about a customer’s children and golf. Her constant moving between different themes and issues, informal and formal, would help her get a feel for the customer and learn what area they can share. The case shown by Østerlund can be regarded as an instance of organizing backstage in the interaction between a salesperson and a customer. Salespeople’s endeavors to organize a backstage seem to be conducted in order to establish a different social relationship beyond the relationship of salesperson and customer.

Use of a dialect serves a function similar to salespeople’s informal talk. In other words, use of dialect marks an attempt to organize a backstage and to establish specific social relations among participants in an interaction.

7.2 Language choice and organization of boundary

Whether a certain situation is frontstage or backstage, or at the boundary between them, is marked not only by time and space, but also by the use of certain words, or register/language choice. Let me show some cases concerning language choice and
organization at the boundary between the front and backstage.

Use of dialect

The use of dialect observed in this lab was an example of language choice. The day before or even until a minute before their turn in periodic lab meetings, students prepared presentation materials. In the periodic lab meetings, the professor used both standard Japanese and dialect, whereas Japanese students used formal Japanese. This indicates that this meeting, which is a frontstage for the students, is a backstage for the professor. For the professor, the meeting was a backstage in preparation for the frontstage of conferences, or another public presentation event such as master’s and doctoral students’ final public presentations. The two kinds of stages are multilayered in this boundary space.
Use of English

The use of English by IGSs was marking a specific situation. However, for Japanese students, the use of English is a performance on the frontstage. Not only the occasional presentations in English by the selected members of the lab, but also all kinds of situations where they needed to use English to interact with IGSs felt like the frontstage for them. There were various situations in which Japanese students had to use English with IGSs to explain how to use a machine, when to use tweezers, when to use disposable gloves to maintain a clean environment, how the maintenance of a machine was progressing, whom to talk to when a certain chemical ran out, how much money they needed to collect and why (to buy a farewell present for the secretary who was leaving, for example), and by when to pay to participate in a certain lab activity. These were situations in which they needed to display their English ability, which they acquired in school as one of the subjects mainly to pass university entrance exams. While English was their frontstage language, their backstage language was casual Japanese (a mixture of standard and dialect spoken in the area), but certainly not English.
The use of English was tied to organizing a particular type of situation. It was recognized as a special situation because when a Japanese student spoke English to an IGS, others would tease him for his use of English, for example. This was a case of Japanese creating a boundary by showing resistance toward English use. For many Japanese students in this lab (and in other labs), communicating in English was painful. They learned English as a subject to pass exams, not for communication in real life. English was seen more as a source of embarrassment than as an enjoyable tool of communication to open the door to wider possibilities of knowing other people and cultures. As mentioned in Chapter 6, the remark made by one of the students expressed a typical problem and the pain of speaking in English: I have to communicate in my lower-than-junior-high-school-level English. Toshi said the following. “I understand that English is important. IGSs need English, but I don’t. Even if I cannot use English, nothing bothers me. English is something you learn when you feel it is necessary.” He also said “I have resistance toward English, but I think I should do [“study” or “use”] it. If I go abroad, and if it becomes a necessity, if I have already become used to it (English
speaking environment), there will be less resistance. If there is a chance, I might go abroad. Even after I start working for a company, I will present abroad. For this purpose, too, [I should use English]” (Toshi, 3/12/2001).

The case of the Japanese student Jun also shows how the use of English is tied to a particular situation. Jun was laughed at by other Japanese students when he presented in English. He came back from studying abroad in a European lab and he presented in English at the first meeting upon returning from Europe. Jun’s case will be explained in detail in Chapter 8.

Another reason why English-speaking situations appeared to be on the front stage is that the professor had no problem with speaking English. He was an active scholar and he had spent some time in the U.S. doing research. Thus for him, speaking in English was different, but nothing special. The European IGSs in this lab presented in English at the lab meetings, and they consulted with him in English when they needed his advice. When Japanese students talked to him, it was formal Japanese, and the content of the talk was almost always about business, such as research related issues (about the progress of
research, for example) or lab-organization related issues (his availability for the purpose of detailed scheduling of lab-activities, for example.) From both the use of formal language, and from the content of conversations between the Japanese students and their professor, we could say that he certainly belonged to the frontstage and his facility with English marked the language as a frontstage means of communication.

The following case shows how language choice marked the front and backstages of the community. Toshi said that he did not want to study English in order to communicate with IGSs. He said that he would learn it when it became necessary for him. The use of Japanese was also perceived by some Japanese members as an indication of those IGSs’ willingness to participate. On the other hand, Fumiko, who had come from another lab at another university, was a student who did not feel so special about the use of English. That was because it had been part of the practice in her previous lab. There everyone used English, including “broken English” and chanpon (a mixture of Japanese and English words). In S Lab, the use of English constructed a frontstage where Japanese students could not behave freely. On the other hand, speaking only in casual Japanese,
resisting IGSs, and bad-mouthing indicate backstageness. In Fumiko’s previous lab, even if the sentence structures are not correct, or even if the two languages are mixed, the members did not mind using English. This indicates that the boundary between frontstage and backstage is not organized by language in an absolute manner, but rather the use of language to organize frontstage and backstage is highly situated (context-specific, local, etc.) in nature. These cases illustrate that speaking English had the function of organizing a boundary between frontstage and backstage in S Lab.

Over the years, I also observed and heard in the interviews that students started feeling less resistance toward English use a few years after European IGSs first came to the lab, and after having Japanese members such as Jun or Fumiko who would share their practice of using English learned in other contexts. This means that the S Lab CoP as a whole learned and to some extent shifted its trajectory.

It can be said that it is vital for a CoP to learn and change in order for IGSs to participate easily.

The cases above illustrate various frontstage and backstage situations organized in
the lab CoP in addition to formal and informal activities previously discussed. The fact
that various situations are organized implies that various boundaries are simultaneously
constructed, which in turn differentially enable members’ access.

By seeing these cases, we can understand that participation in a CoP is a very
tricky business. Participation in a CoP does not mean participating in flat, uniform,
monotonous and sequential activities. Rather, it means participation in various activities
or situations constructed mutually by members, and involves the negotiation of
boundaries.

Since the activities and the situations organized in a CoP are varied, and the ways
of participation in a CoP vary, it is easy to imagine that the formation of identity in a CoP
may also vary beyond merely becoming a member. Moreover, these cases above suggest
that identity formation may be related to trajectories of participation crossing multiple
CoPs, rather than simply related to a single trajectory of participation within a unique
CoP. In the next chapter, we will look at cases in which the multiple ways of participation
and multiple ways of identity formation are related.
CHAPTER 8
IDENTITY FORMATION THROUGH BROKERING IN SCIENTIFIC PRACTICE

“My English became much better. In my country, I could speak English no problem. But I had problems communicating here (in Japan.)” (10/12/2001, Max)

8.1 Participation through finding and constituting a unique self

Although situated learning theory provided a new perspective to learning, in the early stages of its theoretical development it described participation in a CoP and identity formation as a linear process, from peripheral to full participation, or in the other direction from full to marginal participation (Lave & Wenger, 1991). However, the variety of activities and occasions, that have already been illustrated, including formal/informal or frontstage/backstage performances, show that a linear conceptualization is too simple. Furthermore, in a CoP, there are various members with different backgrounds and different roles in the CoP and as such, their ways of participation are not unitary but diverse.
Since modes of participation in a CoP are diverse, "finding or constructing one’s position" in a CoP entails three issues. First of all, by finding a position in a CoP, it is possible to discover and form a different self. In short, the actual structure of participation may be redefined as finding a new position involving the creation of a new identity, which goes beyond merely becoming a member of a CoP. In this way, the formation of identity in a CoP may be conceptualized as discovering and constituting unique aspects of one’s self. Second, seeing participation as finding a new position in a CoP is then the flip side of creating one’s new identity. Third, identity formation as discovering and constituting unique aspects of oneself by participating in a CoP is closely related to one’s crossing of multiple communities, as Dreier (1999) and Lave (1997) argue. A unique position and unique aspects of oneself are made visible and come into being through one’s trajectory of participation across multiple CoPs as in the case of “knowledge brokers.” In writing about this notion, Wenger (1990, p. 164) refers to the work of Eckert (1989) as pursuing similar lines of thought. Knowledge brokers have a

20 Here, “self” is not considered as fixed and stable. Rather, it is formed and made visible in various ways in according with situations and relations.
unique position in a CoP by participating in other communities as well. They may introduce new styles and new ideas into their peer groups. Styles and ideas then come into being as a result of a broker crossing communities. By introducing new styles and ideas from other communities, a broker may find and constitute a unique position and self in a CoP.

Finding a position leads to the organizing of learning opportunities as well. Depending on one’s position in the CoP, one’s learning opportunities can become confined, as in the case of Karl. On the other hand, depending on one’s position, one’s learning opportunities can become enhanced, as in the case of Max. Thus, one’s position and learning opportunities mutually constitute each other.

An IGS is a typical case of a person crossing multiple CoPs. Therefore, there are substantial differences between an IGS and a Japanese graduate student including an IGS’s non-nativeness. By entering a Japanese lab, these differences will become visible.

These differences could be the source of restrictions, or of enabling conditions to make participation easier for IGSs. Thus clarifying how IGSs found or constituted
positions in a CoP and formed their identities through their unique qualities could lead to
specifying the conditions for IGSs to have rich learning opportunities.

Moreover, to meet their needs (such as completing their degrees), it is
indispensable for IGSs to find or constitute positions in the science lab CoP that promote
rich learning opportunities. Therefore, clarifying how IGSs found or constituted unique
positions in a CoP will inform us about how to design learning environments that would
respond to IGSs’ needs.

In the examples below, first of all, I would like to illustrate the case of identity
formation of brokers who move across CoPs and bring new knowledge and trends into a
CoP.

8.1.1.1 Max’s English

As mentioned before, Max tried to become a member of the Japanese M.S.
(master of science) student CoP, and indeed he succeeded. Through this process of
becoming a member, his uniqueness also became increasingly clear at the same time. For
example, he became the lab authority on English. Max's English upon his arrival in Japan was not very fluent. Table 1 of Chapter 4 describes his background. I had a hard time understanding his English when I was speaking to him. He had certain systematic grammatical mistakes generated from trying to transfer his L1 speech into English. He said that he also tried out in English certain expressions used in his first language, which also did not work. For example, the English word "probe" means something different in his first language. He also told a Japanese peer that "private" means bathroom in English, which is not correct. During his years in Japan, his English has become quite fluent. Once I heard Nagata, a Japanese master's student, asking him "how a native speaker felt," although Max was not a native speaker of English. Having a Caucasian appearance, and being advantaged in his linguistic background (for example, both his first language and English share the use of the same alphabet, as opposed to Chinese characters used in Japanese), he became an authority on English in the lab CoP even though he was not a native speaker of English. For example, when Tamada, another

21 I will not mention what probe means in his native language, in order to protect his identity.
master’s student, was told to prepare an English version of his paper, Max helped him
with his English writing (10/12/2001).

Max said, “My English became much better. In my country, I could speak English
no problem. But I had problems communicating here (in Japan.) Reading is OK and
listening.” I asked him how he improved his English. He said, “by talking to others.
Talking, talking, talking, talking to my friends.” I said, “So the fact Karl was here was
good.” Max responded, “Well, I talk to my neighbor and his wife (a foreign couple, one
of whom had lived in the U.S.), five times more. The problem is that they don’t drink
beer like Karl. I talked to my friends in English before. I didn’t do that, like when I was
in the Japanese Language Intensive course.” (10/12/2001) One day, when we were
talking, I was surprised that he was talking like a member of the Italian Mafia in New
York. When I told him that, he laughed and I also noticed that he was downloading a
gangster movie starring Al Pacino and Robert De Niro. It was interesting and even
somewhat entertaining to see a European graduate student speaking like a New York
Italian Mafia member in his science lab in Japan, surrounded by Japanese students. He
also read English newspapers on the Internet. His connection with other foreigners and
English, especially American English resources was clearly evident, and these helped him
improve his English.

Max's case may seem like an exceptional case, but I have observed other
European students improve their English after coming to Japan. Fukushima (2003, p. 15)
has also reported IGSs improving English is not unusual. On the other hand, Japanese
students do not improve their English, even when they spent long time in a lab with IGSs.

Why? Why not?

When government-sponsored international students arrive in Japan, they move
into dormitories prepared for international students. There, students form informal
networks. After a few years, they have to move out of the dorms, but they maintain their
network. Once I went to an international student's farewell party. He was another Eastern
European who had improved his English. At his farewell party, I was surprised to meet so
many people in his small apartment. They were from many different parts of the world:
both Eastern and Western Europe, the U.S., South America, and Asia. Some of them had
been living in Japan, and some had just arrived. They were in different fields, such as medicine, Japanese literature, and engineering, even though the departing student was an economics major. There were people from other universities and institutions as well. The student even received a phone call from a Brazilian who was back home for vacation calling to say goodbye to him during his party. I have also heard that international students say that they have attended birthday or farewell parties of people that they had never met before. In this kind of private international student party, “if you are a friend of a friend, you are invited,” and English is used to exchange information of all kinds and make comments about Japanese\(^{22}\). This is how IGSs tend to improve English while living in Japan. On the other hand, Japanese students do not improve their English because they do not have connections to the English speaking community, even if they spend a long time with IGSs in a lab.

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\(^{22}\) Japanese students are usually not invited to these parties. This does not mean these IGSs did not have any Japanese colleagues or friends to go out with. Rather, it shows that their gathering was IGSs’ backstage where they would discuss about Japanese behavior in drinking situation, for example. They were organizing a boundary.
IGSs also know more than the Japanese about the conditions of other labs. Japanese students often say that they do not know what it is like in other labs, but IGSs often know about other labs, and for good reason. They use the information about the conditions of other labs to negotiate certain things in their labs with faculty members. For example, professors often ask them to shorten their Christmas vacations, but they negotiate for longer vacations so that they can go home and spend time with their families and friends.

This is further evidence of the existence of an international student community and network. IGSs are keen on gathering more information through informal networks to make up for their limited communicative ability in Japanese.

Going back to Max's case, he improved his English by being a part of the English speaking community, and he brokered that into the lab. This was part of his identity as a broker. Being a member in another community, a community of English speakers, was a very important resource for Max to cross boundaries, and to broker. By being a member of this community, he improved his English while he physically stayed in Japan. He
could broker this ability by being recognized by Japanese members in the lab. This became possible because he participated in various lab activities. By participating, other members in the CoP had more opportunities to recognize his ability. However, Karl who was fluent in English from the beginning, did not have a chance to be recognized as such because he did not participate in the lab activities like Max did.

This contrast shows two things. First, English language was potentially symbolic capital in the lab and it was realized as Max’s linguistic capital (Bourdieu, 1977) with the approval of the members of the CoP. Max built his identity of “Max, the English expert” by utilizing this linguistic capital as one of the cores of his identity in the CoP. Second, the fact that Max’s English improved while he was in Japan serves as testimony to his participation in the English speaking community.

8.1.1.2 Max’s math

Max was also accepted as a person who was good at math. On the day of a final examination, as soon as the professor left, Japanese M1 students gathered around Max
and copied his answers (9/16/1999). He later told me this story several times with a smile.

How did Max gain so much trust among the Japanese members so that they would copy his answers?

Max was very good in math and physics. He said, “I didn’t have to study hard. I don’t know why but I always got good marks in math and physics” (Max, 10/12/2001).

Because the level of math education in his country was higher than that in Japan and because he was talented in math, math was not a problem for him.

However, in the beginning, he experienced difficulty in classes. For example, on one exam, he could not understand the exam question itself because it was written in Japanese. However, the professor left the room hastily, and he did not have a close enough Japanese friend whom he could ask to translate the question into English during the limited time of examination (6/23/1999). Around that time, when Max was trying to find out about homework, I observed a Japanese member treating him in an unfriendly manner. While being treated like an outsider, Max told me “M1 (students) are the most important people (in his lab life)” (6/18/1999). Max at that time was trying to enter the
M1 CoP, but did not quite know how to gain entry, so for a while he roamed around the M1 CoP. Upon trying to enter a Japanese lab community, IGs are often daunted by their experiences trying to enter a Japanese lab community, and may feel a sense of loss which seems very similar to that experienced by the protagonist, “K” of Franz Kafka’s novel “Shiro, The castle (Das Schloss, 1922)” experienced. One female student from Thailand (FS3) also expressed her difficulty (Sawyer & Mito, 1998, pp. 70-71). She said she had many friends (both males and females) in her country, but she had a hard time finding her place in her Japanese lab. She tried to find topics so that she could talk to Japanese lab members. She brought her graduation picture from her country, or quizzes about her country in order to have topics of conversation. She, like Max, was roaming around her lab CoP. Max once told me that he brought a two-liter bottle of beer to a Japanese student at the end of a day hoping to drink it with all the other M1 students. To Max’s surprise, this Japanese student thanked Max and put it under his desk. Max never had a taste of it.

Though Max’s math ability was not recognized as capital when he was in his own country, in Japan he had an advantage over other students, despite the fact he was weak in
Japanese. Toshi told me that he was impressed by Max’s math ability when he was

copying Max’s homework. Gradually, Japanese students discovered his math ability and

eventually accepted him as a person who could be an asset to them, who could help them.

He was accepted as Max who is strong in math, through participating in the various

formal and informal lab activities with M1 students. They trusted Max’s math ability and

they trusted him not to tell any faculty members about their conduct. Max became a

trusted member in this CoP, and that was how Japanese students felt comfortable enough

to copy Max’s answers. By brokering his math ability, he found a new position in the lab.

Cases 1 and 2 show the formation of Max’s identity into that of a broker. Cases

like Max’s were also observed among Japanese members. In the following section, I will

introduce the cases of two Japanese lab members, Fumiko and Jun.


8.1.2 Fumiko’s case

A doctoral student, Fumiko was different from most of the other students. Besides

being the only female student, she had working experience in a well-known company,
and she had also studied at another university. Since the majority of the students come
from the undergraduate program of the same university, they usually know or at least
recognize each other from previous classes by the time they come to labs as seniors or as
master’s students. In this sense, Fumiko shared more similarities with IGSs than other
Japanese students did. She also had no previous acquaintances, and like Max and Karl
who were non-Asians, she stood out as a non-male. Like Karl, she did not have to take
classes with other members of the lab. Moreover, her doctoral student status
automatically exempted her from all the preparation chores related to lab activities. As
was mentioned earlier, this preparation work had no academic value, but it helped
newcomers build a network which led to access to various kinds of resources in the lab.

Because of her restricted participation and status as a newcomer, Fumiko was in a
disadvantageous position at the beginning. However, she was successful in finding her
position in the lab CoP. In this lab, students did not know how to use lathe or milling
machines, but Fumiko did (she was calling this “metaru waaku (metal-working skills)”) since she had come from a different lab. One day, I noticed that she was shaving her
finger tips with a knife. I was surprised and asked her what she was doing. She told me that it was not painful, after one uses a lathe machine, one has to remove small pieces of metal from one’s fingers by tweezers, but smaller pieces have to be shaved off with thinly shaved skin. She also told me that Japanese students who had almost never talked to her were also curious about her shaving and started talking to her. She was actually making parts to fix a broken machine. The machine had been broken for some time and the professor wanted someone to fix it, so she volunteered.

Fumiko was able to find a position in the lab by demonstrating her metalworking skills while attempting to participate in activities such as cleaning the lab and persistently asking other members the implicit rules of experiments, such as when one could use tweezers without disposable gloves and when the gloves were essential.

Fumiko’s doing metalworking for fixing the lab’s broken machine can be regarded as brokering a technology from another lab to S Lab. She also tried to organize her learning environment by forming an informal network through participating in various non-academic lab activities and creating more opportunities for interaction.
Fumiko also brokered English ability. When I interviewed Japanese students, I found that Fumiko was respected for her metalworking skills and for her competence in English, among other things. Students also knew that she was in the lab for extensive hours everyday, on weekends, and even on New Year’s Eve (New Year’s Eve in Japan and Christmas Eve in many Western countries share very similar characteristics in that people spend this season together with families and friends, and do not work.) Both students and faculty members indicated to me that staying in the lab for a long time was a respected practice.

Fumiko told me that she had never been abroad, and she evaluated her English as “broken English.” Actually, her English was not “broken” and she was able to communicate with all members, Japanese and IGS alike. Fumiko said that she felt that her English was not so good, but she did not feel shy about speaking. However, the Japanese students in this lab were shy, and had mixed feelings toward English, she felt. She told me that in her previous lab, everyone used English. There were visiting scholars and students from abroad, and she said, “(in that lab,) Japanese students were not
ashamed to speak in broken English."

Bringing skills and different identities from her previous lab as a person with metalworking skills and English ability, Fumiko succeeded in acting as a broker. She also presented a different way of being, demonstrating confidence in English speaking even though she had never studied abroad.

8.3.1 Jun’s case

Another Japanese doctoral student, Jun, became a member of this lab when he was a senior student (as an undergraduate), and during his master’s course, he went to Europe as an exchange student. After coming back from Europe, in the periodic lab meetings, he gave his research presentations in English. Max told me that the Japanese students started laughing, because they felt it was funny that Jun, who was a Japanese student, was presenting to them, the Japanese audience, in a foreign language. However, after the meeting was over, one undergraduate student came up to Max, and said in an excited voice that he wanted to become like Jun. Max was excited and was smiling with
joy when he told me about this. What Jun brought back to this CoP is the identity of a researcher in the international academic community who did not feel embarrassed to present even to his peers in English.

Jun told me in an interview that when he was in Europe, he saw how his professor was good at taking a vacation with his family and that his professor left his office early in the evening. He learned how to manage time and how to be efficient. Back in Japan, faculty members stay in their labs for extensive hours and even come to the lab on weekends. In many labs in a variety of fields in Japan, it is expected that members spend long hours in their labs. Many IGSs (especially the ones from Western countries) find this Japanese habit of staying for a long time very difficult to accept. For many IGSs, this long stay seemed longer than necessary. Jun saw a model of his future self. He saw how he wanted to be as a scholar. For example, he wanted to have his own privacy without sacrificing the quality of his research. After coming back to S Lab, he started being efficient about time.

In interviews, students have indicated that they feel envious of European students’
taking long breaks or their going home early. Some of them said that they were not
interested in European students’ time off issue. A student said, “They (IGSs) are different
from us.” However, in Jun’s case, taking time out or going home early was respected
because he was one of them. He not only displayed English speaking skills, but also
showed a different work and life style, which he brought back to this lab from his
experiences in Europe. Thus Jun, a Japanese student in the lab, by providing a new vision
of enjoying one’s private life while still being efficient and maintaining the quality of
research, served as a meaningful example for the other lab members. Jun brokered new
ideas and showed a possible different identity and way of being.

8.3.1 Karl’s case

Karl also discovered and developed different aspects of his self and found his
position in the lab. His form of participation was virtually non-participation. Before he
came to Japan, he thought that he could become a member of the lab without much
trouble, although he was a little worried that the Japanese lab would be more advanced
than his lab. He was even a little excited to study Japanese language. He told me that he
was a good language learner. He also expected Japanese university students to be more
fluent in English. After he arrived in Japan, his Japanese study suffered from a number of
unexpected factors, and he eventually gave up on it. The Japanese students in the lab
were not willing to speak to him in English. He lost interest in interacting with the
Japanese students and did not participate in various activities except academic ones.
Karl’s fluent English could have become capital. However, unlike Max, he never became
close to the Japanese, thus his knowledge never became linguistic capital in this CoP, and
he could not broker his capital.

A comparison of Max and Karl shows that discovering and nurturing unique
aspects of one’s self can lead either to participation or non-participation. For example, if
there were many members who were like Fumiko or Jun, the possibility of Karl’s
participation would have had much more of a chance. Karl had the potential to be a
broker, but the conditions in this particular lab were not favorable to the development of
this position. Since the Japanese students in reality put peer pressure on each other not to
speak in English. This made Max’s position as an interpreter, the person who could speak both English and Japanese, possible at the same time. The fact is that Karl’s non-participation depended on his trajectory of participation - which contrasts with Max’s case - as well as on the nature of this CoP. Karl could not participate in this CoP because this CoP did not recognize Karl’s capital and could not accept his heterogeneity.

As we have seen so far, the ways of participation and the formation of identity of a newcomer IGS are mutually constituted by both the CoP and the newcomer.

8.2 Positions, capitals and identities

The cases above show that intellectual capital, which became constructed or visible, came in all varieties. Members’ positions and the identities formed in relation to those positions were also full of variety. Moreover, these cases allow a deeper understanding of what “intellectual or technological capital” is. One thing that became clear is that “intellectual or technological capital” is not given. For example, being competent in English does not necessarily translate into capital in the lab CoP. Karl’s
English was very good, but it was never recognized as capital in this lab. On the other hand, Max's English was not so good at the beginning, but by participating in the CoP, he came into being in the lab as "Max the English expert". Japanese students wanted to ask Max's opinion when they had troubles or questions in English, whether academic or not.

Max was not a fluent speaker of English at the beginning, but became one by participating in the CoP, and by being accepted as a person with English expertise.

In Fumiko's case, she had metal-working skills that she learned while she was at another lab as a master's student. This skill was nothing special and was not capital in her previous lab, but in this lab, it was a novel technology. Thus, it was accepted as technological capital. Her English was nothing special in her previous lab, but in this lab, it was also recognized as linguistic capital.

These cases illustrate that knowledge and technology themselves do not necessarily become capital by themselves. As it was shown by Karl and Max's contrasting cases, whether or not one's knowledge or technology can be constituted as capital is dependent upon one's way of participation in the CoP and this was perceived as
capital in the eyes of community members.

For example, as discussed earlier, Max made his English and math ability visible to the Japanese members and to himself through participating in various activities. On the other hand, Karl’s English was not recognized as capital either by Karl himself or by the other members because Karl did not participate in various activities.

Becoming a broker in a CoP, or participation in a CoP as a broker, and the transformation of knowledge or skill into capital, are mutually constituted activities. Position and identity formation in a CoP cannot be separated from capital formation. Being recognized by the members of a CoP as an owner of a certain capital can only be accomplished through the simultaneous formation of a CoP valued identity through participation. Thus it can be said that the capital in a CoP, and the position and identity that come along with it, are formed by the trajectory of participation crossing multiple communities.

Cases seen thus far show that the formation of an identity extends beyond Wenger’s (1998) interpretation of adjustment within individuals of the relationships in
several communities. For example, a member not only acquires a position as a broker or forms such identity by bringing in the knowledge and technology which existed in other place, but also it is possible for her or him to bring about a change in the CoP, and sometimes even change the relationship between CoPs (such as creating a linkage between them or producing a boundary between them.)

8.3 Organization of boundaries and identity formation

The cases thus far illustrate identity formation through linking participation in multiple communities. In the following examples, contrary to these cases above, I will illustrate identity formation through the organization of boundaries between communities.

The following cases are examples of identities formed through the creation of boundaries between communities. Weider’s (1974) work provides us with a relevant example of this sort of identity formation. Wieder described how a code was formulated at “the halfway house,” a rehabilitation center for narcotic-addict felons on parole.
When talking with residents, staff and I often had a relatively friendly line of conversation terminated by a resident’s saying, ‘You know I won’t snitch.’ Hearing such an utterance functioned to re-crystallize the immediate interaction as the present center of one’s experiential world. ‘You know I won’t snitch’, multi-functioned the immediate environment, its surrounding social structures, and the connections between this interaction and the surrounding social structures. … Thus saying, ‘You know I won’t snitch’, operated as a re-enunciation, or a reminder of the role relationships involved and the appropriate relations between members of those categories. It placed the ongoing occasion in the context of what both parties knew about their overriding trans-situational relationship. … Besides reminding the participants of a trans-situational role relationship were originally and continuously formulated through such utterances as, ‘You know I won’t snitch.’

(pp. 153-154)

In Wieder’s case, “You know I won’t snitch” made the boundary between residents and staff visible, while simultaneously reorganizing the boundary. A community is not something out there, but is something organized and reorganized continuously by the members’ words or actions. At the same time, the resident in Weider’s study affirmed his identity by announcing the community to which he belonged. In other words, becoming a member of the community is, at the same time, organizing the boundary and making communities visible.
Willis (1997) and Eckert (1989) reported cases similar to that of Wieder. Willis described local and informal communities such "lads" and "earholes" organized in schools as an institutionalized and formal system. Lads’ talking about school teachers and earholes illustrates lads’ views about these different communities, and at the same time this can be regarded as part of their conduct of organizing a boundary between them and the other side, such as school teachers or the earholes. In the following, let us take a look at a case in the lab.

After Karl came to join S Lab, he became close to Max. As a result, Max started to reconstruct his European identity. At the beginning of his master’s student days, he was trying hard to become a member in the M.S. CoP and participated in many different activities. However, a while after Karl joined the lab, Max started eating with Karl more and finally stopped eating with the Japanese M.S. students. He often went drinking with Karl and they discussed their work and shared their complaints. As mentioned in Chapter 6, Karl felt resentment toward Toshi’s way of blocking his access to resources, and also toward the Japanese way of letting this happen.
In the above case, Karl and Max were simultaneously reorganizing their “European” identities and the boundary between CoPs by sharing their complaints about the Japanese. In saying that the Japanese had a way of letting this happen, they identified themselves as separate from their Japanese peers, much in the same way that the residents in the halfway house did in Wieder’s study.

In the end, Max reconstructed his European identity, but the process was not straightforward. Peter (a Ph.D. student who came to S Lab a year earlier than Max) commented that “Max was becoming Japanese, or trying to be” (9/4/1999). On the one hand, Max was trying hard to become a part of the CoP as Peter said, but on the other hand, as I will illustrate below, Max was feeling bad about the Japanese at the same time. Identity formation is a tricky business.

Max told me about his resentment toward the Japanese once.

I got tired of being stared at by Japanese. Especially when I am stressed. In a train, or when I am at the gym. When I am exercising, Japanese are counting how many times I can do (Max was talking about machine exercise.) After I finish, they would try to do it one more time than I could do it. As if ‘OK, if he (Max) is going to do it that many times, I will do one time more than him.’ It made me sick. (Max,
Max also studied for classes very hard at the beginning (classes start in April in Japan), and he became seriously depressed. However, in December, Max surprised me by telling me that he was going home for Christmas. When I asked him “ Aren’t you going to miss classes?” He replied, “I don’t care,” with a smile on his face. When a Japanese student heard this, he was quite surprised and tried to confirm if Max knew that he was going to miss a major progress report meeting of S Lab. The Japanese student was so surprised that he asked Max whether he had told the professor or not. Max replied in Japanese that he did, but he also added in English (talking to me) that the professor was so busy that he probably did not quite understand the implication of what Max was talking about. This episode shows the emergence of Max’s new identity, an identity of resistance towards Japanese and his “European” identity. It was a different European identity than what he had before coming to Japan, because he did not have this identity of resistance toward Japanese before he came to Japan.

The cases seen above illustrate that participation in a certain CoP extends beyond
merely becoming a member in a CoP, but is also associated with finding and nurturing a unique part of oneself. These cases have a different significance than the cases of brokering. As in the case of brokering, the instances of formation of heterogeneous self we saw in this section can be understood as being brought about by the participation crossing communities. Furthermore, as we have seen above, these cases of identity formation cannot be reduced to the individual activity of adjusting the relationship among communities. Rather, like narcotics addicts who organize a certain community or make the community visible by telling the code, the members form unique selves by forming subgroups.

In this chapter, I introduced instances of IGSs and Japanese graduate students in order to describe participation in a way of finding or constituting one’s unique position, rather than viewing the participation merely as becoming a member. These cases illustrate that the formation of identity in a CoP can be conceptualized as discovering and constituting unique aspects of one’s self through participating in practice rather than as
merely becoming a member of CoP. In short, the way of participation in a CoP is not something delineated as a linear process, rather, it is more multiple than linear. Since the ways of participation are multiple, they can be regarded as finding or constructing one’s unique position. By finding a position in a CoP, it is possible to discover and form a different self. The actual structure of participation can be redefined as finding a new position involving the creation of new identity, which goes beyond merely becoming a member of a CoP. In short, the formation of identity in a CoP can be conceptualized as discovering and constituting unique aspects of one’s self.

The constitution of one’s unique position and creation of a new identity in a CoP are closely related to the realization of intellectual and technological capital. Participants can obtain their unique position and can create new identity because of their intellectual and technological capital. However, intellectual and technological capital do not have independent existence, but rather, are made visible or constituted through one’s participation across multiple communities.

If participation was thought of simply as a linear process of a newcomer
becoming an old-timer, then understanding IGSs’ participation in a CoP would become quite difficult. In reality, it is virtually impossible for IGSs to follow the process of participation exactly as Japanese graduate students do. However, IGSs are agents who cross multiple communities, and at least potentially, possess different intellectual and technological capital from Japanese graduate students. This in turn provides them with the possibility of finding or constituting a unique position in a CoP.

Max’s case of becoming able to access machines through participation in various activities also cannot be described as a straightforward process of becoming a full participant from a peripheral member. His success was accomplished by shaping his unique intellectual and technological capital and making them visible. Thus, Max could find or constitute a unique position. Thus, participating in various activities offered Max the opportunities to make his intellectual and technological capital visible or shaping them.

As I said at the beginning of this chapter, clarifying how IGSs find or constitute positions in a CoP and form their identity through their unique qualities allows us to
specify the conditions for IGSs to have rich learning opportunities. Finding such
opportunities is essential for IGSs to meet their needs, most notably completing their
degrees. A learning environment that would better respond to the IGS's needs will be
outlined in the concluding chapter.
9.1 Answers to the research questions

In this section, I will first summarize what has been shown in this dissertation by reiterating my research questions and then presenting answers to them. Then, I will reconsider needs and further discuss design of learning environments. The research questions for this study were based on the following observation as described in Chapter 1. I observed that some international graduate students of science could not even interact with fellow Japanese lab members. The problem was not just a linguistic issue; it was about constructing social relations. This lack of interaction meant lack of opportunities to use or learn Japanese. For IGSs, opportunities for interaction in Japanese do not occur by themselves. Rather, the opportunities are closely related to whether or not they participate in research practice in the lab CoP. The problems were that IGSs could not participate in research practice, which includes various activities (such as eating and doing homework together) and situations (such as classes and the cafeteria), and using machines in order to
conduct research. Therefore, I constituted the following research question in order to reconsider IGSs' needs.

Research question 1: How do the IGSs participate in the lab CoP? Through what kind of individual situations and activities do IGSs participate in the CoP? How are these individual situations and activities organized in the CoP?

I addressed these questions in Chapter 6 by analyzing the cases of Karl and Max. Participation in the CoP is achieved through participating in various multi-layered interwoven activities and situations.

As was shown, Max participated in the CoP through participating in various multi-layered and reciprocally related activities and situations of formal, informal, academic, and non-academic natures.

Through attending classes, and participating in such activities as the lunch and dinner gatherings and the planning of a summer trip, it became possible for Max to construct an informal network, and this informal network enabled his access to machines and other vital resources for the scientific practice in the lab. As this example illuminates, the learning of Japanese language does not occur in isolation in the lab. It was shown that
emerging Japanese language learning was accompanied by participation in the CoP, and being able to access the practice.

On the other hand, Karl did not have opportunities to participate in various activities and situations, and he was unable develop an informal network in the lab. As a result, he was limited in his access to machines. The various multi-layered interwoven activities and situations were analyzed in detail in Chapter 7 by applying the notions of frontstage and backstage from Goffman (1959).

Research question 2: What enables the IGSs’ participation in the CoP? What hinders the IGSs’ participation in the CoP?

The answer to these also became clear by comparing the cases of Karl and Max. As Max’s case shows, participation in various interwoven activities and situations enables one’s participation in a CoP. On the contrary, as Karl’s case shows, when one does not have these opportunities, participation in a CoP becomes difficult.

By answering Questions 1 and 2, I showed concretely how opportunities for interaction (which are also opportunities for language learning) are organized.
In short, I showed that participating in various interwoven activities and situations including non-academic and informal activities enables one to form an informal network, and that also nurtures opportunities for using and at the same time learning language. In this way, opportunities for language use and language learning, and participation in a CoP cannot be separated. The language is not a closed system of codes. Rather, language use is a form of practice. This way of viewing participation as “participating in various interwoven activities and situations” can be applied not only to a science lab, but also to other kinds of CoPs in general.

In the case of a science lab, I concretely specified what the various interwoven activities and situations are. By specifying the content of these activities and situations, it became possible to suggest how to design learning environment in a science lab.

Research question 3: In order for IGSs to conduct their own research (such as conducting experiments, writing papers, giving presentations, and completing a degree), what kinds of resources, social organization and opportunities support participation in a lab CoP and access to lab practices?

The cases of Karl and Max in Chapter 6 provide implications for what kind of
learning environment has to be designed for IGSs. One possible way to design an appropriate learning environment for IGSs is to arrange various activities and opportunities, including non-academic and informal ones which help IGSs to develop an informal network in a lab. The details of what kind of activities and opportunities need to be provided would vary depending on places and situations. However, even merely considering these activities and opportunities could possibly make participation in a CoP easier for IGSs. Furthermore, the changes of the CoP that I observed in the process of fieldwork provide implications for the design of learning environments as well. For example, the lab members became more accepting of IGSs and less resistant to interaction in English through the participation of new Japanese members such as Fumiko, who naturally interacted with IGSs in English, and through the participation of IGSs such as Max, who taught English to the lab members. Thus, the changes in a CoP can provide a new learning environment and more abundant opportunities for interaction for IGSs.
9.2 Rethinking “needs”

In this study, I started ethnographic fieldwork in order to conduct a NA for IGSs. I thought that necessary linguistic items, for example, for a scientific presentation, could be identified by recording and transcribing Japanese language data from the lab meetings and by noting other non-linguistic data. However, once I entered the field, I was disillusioned by the gap between what I expected and what was really happening. The language used in the IGSs’ presentations and in the faculty members’ feedback was English, not Japanese. Moreover, for some IGSs, the problems were not about language, but were related to not being able to have opportunities to interact with Japanese students, to begin with. Thus, I realized that a conventional linguistic framework would not be sufficient, and that it would be necessary to reconsider IGSs’ needs not as sheer linguistic needs, but as something broader. The primary needs of IGSs are not to become proficient in Japanese, but to write academic papers by conducting experiments using machines, and to complete their degrees by writing academic papers. By reconsidering needs like this, IGSs’ needs can be thought of in the concrete terms of what is necessary in order to
support their conducting of research and publishing papers.

However, IGSs cannot conduct research by themselves in a lab. The access to machines is socially organized and the knowledge of how to deal with machines is distributed among various members of the lab. Therefore, in order to complete the research process and publish academic papers, participation in the lab CoP is a necessary condition. Thus the focus of my research shifted toward investigating how IGSs were participating in the lab CoP. That is, by specifying what enables IGSs’ participation or what prevents it, I was able to clarify the conditions to support IGSs’ academic activities such as conducting experiments and writing up the results as papers.

Opportunities to learn Japanese could be obtained by participating in the CoP. Participation in the lab CoP offered IGSs opportunities for interaction with Japanese members, and the interactions could also be regarded as opportunities for learning Japanese.
9.3 A way of participation and needs

By examining ways of participation or non-participation, the following point was clarified: participation in a CoP is constructed by participating in multi-layered and reciprocally related activities and situations such as formal and informal, academic and non-academic ones. For example, through attending classes and participating in the planning of the summer trip, it became possible for Max to construct an informal network, and this informal network enabled his access to machines and to the other vital resources for scientific practice in the lab. As this example suggests, the learning of Japanese language does not emerge by itself in the lab. It was shown that emerging Japanese language learning was accompanied by participation in the CoP and being able to access the practice and its artifacts.

On the other hand, Karl, who did not have opportunities to participate in various lab activities and situations, failed to construct an informal network, could not access the lab machines, and did not have chances to interact with Japanese where he could use or learn Japanese.
Furthermore, it was illustrated clearly that the identity of IGSs was formed through participating in multi-layered activities and situations, and opportune through highlighting aspects of their heterogeneity in a situated manner. For example, by participating in multi-layered activities and situations, the members could socially display their knowledge and skills, and because of these opportunities for display, their knowledge and skills became recognized as symbolic capital in the CoP. All of the above were connected to the identity formation of the IGSs in the lab CoP.

The IGSs’ structure of participation in the CoP as shown in this study is closely connected with their concrete needs for conducting research, writing papers, and obtaining a degree. Before outlining the kinds of support IGSs require to respond to these needs, two contrasting perspectives on learning will be reviewed.

9.4 Design for pedagogy and design for learning environment

From the perspective of situated learning theory, what constitutes needs and what has to be designed in order to address these needs differs from solutions suggested by
other frameworks. As previously mentioned, a distinction is made in Lave & Wenger (1991) between a learning curriculum and a teaching curriculum. A learning curriculum is a "field" of learning resources from the perspective of learners, whereas a teaching curriculum consists of specific items, which are prescribed by the instructional side based on their pedagogical view of what knowing is.

Following this distinction between a learning curriculum and a teaching curriculum, the view of what should be prepared for the learners is naturally different. That is, from a teaching curriculum perspective, the method of instruction for learners is designed by composing a series of steps for improving the skills and competence of a learner as an individual.

According to this perspective, IGSs need specific language (linguistic items such as vocabulary, grammar items, and discourse patterns); designing methods to teach these items will presumably address IGSs' needs.

On the other hand, for a learning curriculum, needs are something broader, including the conduct of research and the writing of academic papers.
For these broader needs, the design of the learning environment is what is necessary. This design of the learning environment means designing resources, social organizations, and opportunities, which support the members' participation in a CoP and access to practice. For example, in the design of the learning environment, the primary needs of IGSs' (such as collaboration with other members, research, and publication of the results) can be addressed. Moreover, the needs of an IGS who cannot have opportunities to interact with other members, can be addressed as well. An IGS who cannot find opportunities to interact with other CoP members cannot use language or learn it.

Max's case provides implications for what kind of learning environment has to be designed. As has been shown throughout this paper, Max succeeded in constructing an informal network through participating in classes and a summer trip of the CoP. In contrast to Max, Karl did not have these opportunities. From these examples, guaranteeing activities and opportunities to construct an informal network can be regarded as part of the design of IGSs' learning environment. What kind of activities and
opportunities need to be provided? The details of these activities and opportunities would vary depending on places and situations, but merely considering these could possibly trigger a big change in an IGS's life.

Making participation in a CoP easier for IGSs is a necessary but not sufficient change. The CoP itself needs to go through a change. In Fumiko's previous lab, for example, members were communicating freely in a mixture of Japanese and English. In this kind of CoP, it is much easier for IGSs to participate and there is a rich opportunity for Japanese language learning. In S Lab as well, through several years of my field research, I observed that Japanese graduate students became much less hesitant toward speaking English. The experience of accepting IGSs as members every year, as well as the fact that Japanese graduate students like Jun brought back to the lab the experience of study abroad, were contributing factors and at the same time resources for this change. This shows that a CoP constantly changes through accepting new members. In other words, learning occurs not only in newcomers but also in a CoP in which newcomers participate. Thus, learning can be regarded not as something occurring in individuals
alone but as mutually organized among newcomers and a CoP. By a change in a CoP as described above, for example, not only interaction in Japanese but also in English in the lab will be possible for IGSs. As a result, IGSs will be able to have much more opportunity for interaction than before. The change of a CoP itself, i.e. the learning of a CoP, is equivalent to designing the learning environment for IGSs. For example, if there were many members like Jun in the lab CoP, it could naturally become a learning environment where IGSs could easily access the lab practices, and have interactions with Japanese members. Thus the change of the CoP itself, that is, the learning of the CoP, will provide a new learning environment and richer opportunities for interaction for IGSs.

9.5 Other issues

9.5.1 Identity

It was illustrated clearly that the identity of IGSs was formed through participating in multi-layered activities and situations. Aspects of their heterogeneity were highlighted by their participation in multi-layered activities and situations. For
example, by participating in multi-layered activities and situations, the members could socially display their knowledge and skills, and because of these opportunities for display, their knowledge and skills became recognized as symbolic capital in the CoP. All of these concerned the identity formation of the IGSs in the lab CoP.

9.5.2 Ethnography network

As it has been illustrated, needs change depending on both the space and time of one’s trajectory. Needs are not something which lie around here and there, waiting to be discovered by needs analysts. Needs are not given entities. Thus, it is important to consider needs as evolving.

Considering the dynamic nature of needs, there is a certain limit to questionnaires, interview surveys, or text analysis. It is difficult to capture the needs discussed throughout this dissertation by these methods. When one tries to grasp varying, changing needs unknown to the learner herself, it is impossible to use conventional methodology or base the research on the social system these methods presuppose. In the overwhelming
majority of conventional NAs, researchers/needs analysts were able to contact the participants only once or several times during the period of research. Thus the distance between the researcher and the field was large.

Strategically thinking, one might propose: there is a need to construct a new kind of social network between researchers of Japanese language education and the field that they study (the participants in their full range of contexts). Currently, in most cases, neither the researchers nor the educators have been trying to build a tightly woven network in the field.

Either way, in traditional NA, the field has been accessed only through very indirect methods such as questionnaires and text analysis. Thus it would be useful to organize a system that better links the field with Japanese language teachers and researchers. At the same time, a different method is also needed. The following excerpt from Heath (1983) provides a valuable hint for this.

The teachers of this book are portrayed as learning researchers, who used knowledge from ethnographies of communication to build a two-way channel between communities and their classrooms. (p. 354)
Heath’s idea is useful for building a supporting network for IGSs. For example, instructors and graduate students could not only teach Japanese in class, but could also build a system whereby they periodically conduct field research outside the classroom. Or, by visiting fields outside of classroom, they could support IGSs’ communication in the CoPs in which they participate.

By developing a system which links the language classroom and field, it would be possible to capture ongoing needs, and the Japanese teaching in the classroom would become more realistic as well. My research is a starting point for organizing a new ethnographic network as described above.

Although I never thought that the issue of IGS needs would be simple, it turned out to be much more complicated than it seemed at the outset. I encountered various obstacles conducting fieldwork as well as writing up the dissertation, including rethinking the foundation of my whole approach. My rethinking centered around the reification of language. One voice told me that since I am in the department of East Asian Languages and Literatures, I must start from language. On the other hand, I could not ignore the reality that IGSs were facing. It took me a very long time to come to terms with these two, but in the end, I decided that the learner in her entirety should come first.

Thus I would like to promote the idea of design of learning environment. Together
with students’ and instructors’ day-to-day practice and effort, we can create new and exciting learning environments, I believe.
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Appendix 2. Layout of S Lab big room.
Arrows show the faculty members' seats (right to left: the senior research associate's seat, the associate professor's area (surrounded by cubicles), and the junior research associate's seat (bottom, near the door.)
REFERENCES


work published in 1975)


Psychology, 15, 1-38.


New York: Cambridge University.


Muraoka, T. (1999). Noogaku kei nihongo ronbun no zairyoo oyobi hoohoo de mochiirareru bunmatsu hyoogen to bunkei. [Commonly used Japanese sentence

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