Youth Mediated Communication: Knowledge Transfer as Intercultural Communication

Toshiyuki Takasaki, Yumiko Mori, Toru Ishida and Masayuki Otani

Abstract Transferring knowledge to other people in different languages is difficult because of gaps in languages and cultures. It makes the knowledge transfer more difficult when the recipient is young, because the comprehension and language ability of the young are incomplete. To better understand and design language services, this chapter introduces a communication protocol that meets requirements of agriculture support in rural areas, and fully delineates the communication environment by elucidating the field issues comprehensively; solutions are considered. The field experiment conducted involves agriculture support in Vietnam. In the context of agriculture support in rural areas, there exist several issues such as the requirement of timely knowledge transfer with high translation quality, and multilingual communication between youths and experts where gaps in language ability and expertise should be considered and addressed.

Keywords Knowledge communication · Multilingual communication · Youth Rural development

T. Takasaki (✉) · Y. Mori
NPO Pangaea, Zou Bldg.301, 509 Kyogokucho, Kyoto 600-8035, Japan
e-mail: toshi@pangaean.org

Y. Mori
e-mail: yumi@pangaean.org

T. Ishida
Department of Social Informatics, Kyoto University,
Kyoto 606-8501, Japan
e-mail: ishida@i.kyoto-u.ac.jp

M. Otani
Department of Informatics, Faculty of Science and Engineering, Kindai University,
3-4-1 Kowakae, Osaka 577-8502, Japan
e-mail: otani@info.kindai.ac.jp

Y. Murakami et al. (eds.), *Services Computing for Language Resources*,
Cognitive Technologies, https://doi.org/10.1007/978-981-10-7793-7_13

1 Introduction

Infrastructure of ICT, Information Communication Technology, has been developed quite rapidly even in rural areas of developing countries. However, people in such area still have not found meaningful way to use them in their daily lives compared to people in cities. Though literacy rate of adult is still low, many countries are now putting their efforts to provide good education system to their children and literacy rate has improved significantly for younger generation. In many cases of ODA, Official Development Assistance, to support agriculture, environment, or health care in developing countries, programs do not employ ICT environment, but rather experts travel to these locations physically and implement effective ODA programs. Because the local people cannot read or write, it is difficult to accumulate knowledge from experts in the local community. As an alternative approach to support rural communities in developing country, Mori proposed the communication method called YMC, Youth Mediated Communication, to support illiterate workers (non-experts) through their children who are literate and computer-literate, especially in rural areas in developing countries [11]. In order to verify the proposed YMC model, this chapter shows a field research to implement YMC model in rice farming domain in Mekong delta area of Vietnam.

The purpose of this chapter is to create an intercultural communication environment that links Youth and Expert to support agriculture in developing countries. Agriculture knowledge is transferred from Expert to Youth in different languages. It is difficult to achieve this because the issues include knowledge gaps as well as language gaps. As for intercultural communication, many previous studies have described the utilization of machine translation technology. The goal considered here, that of knowledge transfer, requires very high translation quality required. Because translation quality of machine translations is not perfect, we need to design appropriate language services that can combine machine translation and human support in the most efficacious manner. Note that key issue is to well address the knowledge gap between Expert and Youth. Previous studies on interdisciplinary communication among people with different expertise have been reported. The research in this chapter takes an empirical approach, which means that we design a communication protocol by exhaustively extracting field problems and identifying solutions. Then, we implement a communication system environment, and conduct a field experiment in a rural area in Vietnam. Finally, we evaluate the effectiveness of the communication environment in countering each field problem.

Two issues must be addressed in order to implement interdisciplinary and intercultural communication environments wherein young adults and agriculture experts can communicate by using their mother tongue. The first issue is the communication difficulty raised by language differences and knowledge differences. There has been research on interdisciplinary communication among people with different expertise, and there has been research on intercultural communication among people with different languages. As for interdisciplinary communication, because there is a difference of knowledge, you need to be aware of the knowledge difference when communicating with your counterpart. It may be necessary to strengthen communication by, for example, adding more explanations of technical terms [2, 3]. There may be a misunderstanding or lack of understanding if the you use words in different meaning from your counterpart's use. In order to facilitate interdisciplinary communication, it is necessary to apply a mechanism to identify the situation of misunderstanding and lack of understanding. Also, it is important to apply a mechanism to support knowledge transfer and bridge the knowledge gap.

The second issue is the difficulty of implementing an intercultural communication environment supported by machine translation that creates high quality translations while easing the loads placed on the users. There has been research on intercultural communication to realize social communication via email or chat systems that is supported by machine translation [1, 6]. For example, one study compared the productivity and degree of understandings between communication based on machine translation, and communication within the same language group. Technical issues in machine translations that interfere with social communication have been analyzed [16]. In the case of machine translation among Asian languages, or between an Asian language and a European language, pivot translation via English is utilized [15]. Because pivot translation cascades multiple machine translation engines, translation quality is lower than is true with a single machine translation engine. Our research proposes to enhance the translation quality in pivot machine translation by applying a context-based approach to communication [13]. The focus of this chapter is translating knowledge and thus high quality translations are necessary, so using only machine translation is not good enough. On the other hand, human translators are expensive; that is especially true of experts. In addition, it is difficult to retain those human resources continuously.

2 YMC (Youth Mediated Communication) Model

We discuss a communication method of multilingual knowledge transfer. We assume the scenario in which that Japanese agriculture experts assist, online and in a timely manner, farmers who live in rural areas of developing countries. In previous similar situations, agricultural experts had to visit the local rural areas physically, and they taught the farmers directly or local extension workers, who are in a position to instruct local farmers, with human interpreter support. Unfortunately, the cost of dispatching experts was so high that this approach is now seldom used. Also, it is difficult for local farmers to retain the experts' knowledge to utilize in the next farming stage, because local farmers are illiterate and they are unable to record the knowledge.

Mori proposed the communication method called YMC, Youth Mediated Communication, to support illiterate workers (non-experts) through their children who are literate and computer-literate, especially in rural areas in developing countries [11]. Figure 1 shows the conceptual diagram of YMC. YMC is a means of communication that transfers expert knowledge from the expert to a non-expert via a young adult of the same rural community.

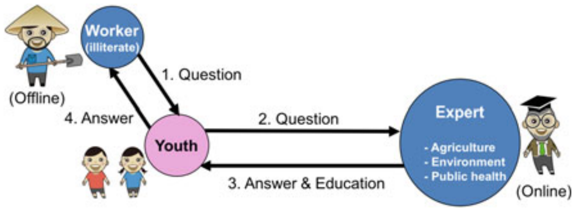

Fig. 1 Diagram of youth mediated communication

3 System Design

3.1 Requirement Analysis

In order to investigate the YMC method, an intercultural communication environment between agriculture experts and youths was designed and implemented to support agriculture farming in rural areas. The online communication system is called "YMC System." Question and answer communication between youths and remote experts was assumed to be the main communication path. In designing the YMC System, we had to comprehensively identify which field problems were caused knowledge gaps and which by language gaps. Multiple solutions were developed for each field problem and the best solutions were chosen. The design process is conducted by experts in agriculture, education, machine translation, as well as farmers, practitioners in intercultural activities, and system engineers. These field problems are utilized to understand the field experiments. Table 1 shows field problems and corresponding research issues.

Table 1 Field problems and research issues

ID	Field problem	Research issue
1	High quality translation is required, because there is a possibility of serious damage to agriculture crop due to miscommunication of knowledge	Language difference
2	Prompt response by expert is necessary, because questions are posted from time to time in agricultural crop growth process	Language difference
3	Expressions by expert are difficult for youth	Language difference Knowledge difference
4	Composing question sentences is difficult for youth	Knowledge difference
5	Knowledge transfer from youth to parent (farmer) at home is difficult	Knowledge difference
6	It is difficult for expert to answer to each question from youth due to a lack of paddy information	Knowledge difference

3.2 Interaction Design

Problem 1 is the requirement of high quality translation in agriculture knowledge transfer. This is essential because the agriculture crop can be seriously damaged to due to miscommunication of knowledge. One of the solutions is to utilize human translators for all information transfers (Solution 1–1). Another solution is to prepare and utilize an agriculture knowledge database holding bilingual parallel texts (Solution 1–2). The other solution is to improve a machine translation quality by human support (Solution 1–3). As for (Solution 1–1), it is costly to continuously keep bilingual translators of Vietnamese and Japanese in the field. As for (Solution 1–2), it is difficult to prepare answer parallel texts that cover all questions. On the other hand, as in (Solution 1–3), Lin et al. showed that refining machine translation texts by humans was cheaper than translating all texts by humans [8, 10]. As a result, this study adopted (Solution 1–3).

Problem 2 is the need for prompt responses by Expert. In some situations, such as the emergence of an infectious plant disease, urgent treatment is necessary. Agriculture experts suggested that a farmer should be answered as soon as possible, within a week at latest. This, unfortunately, places excessive loads on Expert and the people responsible for refining the machine translations. So, the sooner we require a response, the more costly. One of the solutions is to prepare an FAQ (Frequently asked questions) system (Solution 2–1). Another solution is to increase the number of Experts by utilizing crowdsourcing (Solution 2–2). The other solution is to prepare an online system that allows the Expert to compose answer messages by combining his typed messages (Free-text) with bilingual parallel text (Solution 2–3). As for Solution 2–1, it is difficult to prepare a truly comprehensive FAQ database. Even when huge FAQ database is prepared, it is difficult for some Expert users to find the right FAQ due to ICT literacy. As for Solution 2–2, the problem is the limited number of agriculture experts. As a result, Solution 2–3 is selected.

Problem 3 is the difficulties Youth face in understanding the Expert's answers. One of the solutions is to demand that all answers be comprehensible to Youth (Solution 3–1). Another solution is to employ local staff who have some agriculture background and ask them to explain the answer message to Youth verbally in face-to-face meetings (Solution 3–2). The other solution is to place staff online who can modify the Expert's answers into Youth friendly expressions (Solution 3–3). As for Solution 3–1, youth use more colloquial expressions and abbreviations than adults so that machine translation quality is worse. It is too much load for Expert to require the youth friendly expression. Solution 3–2 is not practical due to the limited human resources of local staff with agriculture background. So, we adopt Solution 3–3 and add to the translation flow a "smoothing" task that modifies the answers into more Youth-friendly expressions.

Problem 4 is the difficulty for Youth to ask pertinent questions due to their limited language ability. One of the solutions is to allocate adult staff who can support Youth in writing questions (Solution 4–1). Another solution is to ask Youth to select their questions from the parallel texts held by the agriculture question database (Solution

4–2). We select Solution 4–2 due to the limitation of human resources. Thus the agriculture question database must have a structure and user interface that make it easy for Youth to find what they would like to ask.

Problem 5 is the difficulty for Youth in transferring the Expert's knowledge to their parents or elders. It is assumed that they cannot access the Internet at home. One of the solutions is to give each Youth a smartphone or tablet device that holds agricultural digital materials, to explain what their understanding of what the Expert said to their parents (Solution 5–1). Another solution is to give an agriculture technical book to Youth and let them read aloud the book to their illiterate parents (Solution 5–2). The other solution is that Youth writes down what they learn from Expert and they bring home written notes of agriculture advice (Solution 5–3). Though Solution 5–1 is an ideal solution, there are a couple of concerns. The first concern is the issue of the cost of the mobile device, and the second is the risk of theft. Such mobile devices are expensive given the standard of living in the rural areas of Vietnam. As for Solution 5–2, though we surveyed available agriculture books in the field, discussions with local agriculture experts reached the conclusion that there was no appropriate material. Textbooks for beginners don't cover agriculture knowledge in enough detail to support this project, and technical books for experts are too difficult for Youth understand. As a result, we selected Solution 5–3.

Problem 6 is the difficulty of Expert has in answering Youth questions appropriately due to a lack of site (paddy) information. In the design phase, agriculture experts indicated the necessary information for this project was rice plant height, leaf color, bugs in paddy, photo of rice plants, temperature, humidity, and weather. One solution is to acquire this field data from remote-sensing and the sensors of a field-monitoring system (Solution 6–1). Another solution is to ask farmers (parents) to gather the data in their daily paddy work (Solution 6–2). The other solution is to ask Youth to visit their parents' paddy and gather the data (Solution 6–3). When we interviewed agriculture experts in the design phase, they pointed out that Solution 6–2 and Solution 6–3 were better than Solution 6–1, because the accuracy and data density of field data gathered by humans is better than that collected by machines. For example, it is difficult and expensive to measure accurate rice height automatically. Youth can master data gathering more quickly than their parents, who are always busy with manual work, and come to see this as a fun activity. As a result, we select Solution 6–3.

3.3 Language Service Design

Language services are designed to meet the field needs of the project. Expert composes an answer message by combining preset "parallel texts" and "free text" in the Experts' mother tongue. Because the highest possible translation quality is required, the translation flow is designed as a combination of machine translation and human refinement. This communication model requires Bridgers for each language as shown in Fig. 2. Lin & Ishida described the detail design process of the translation service [7].

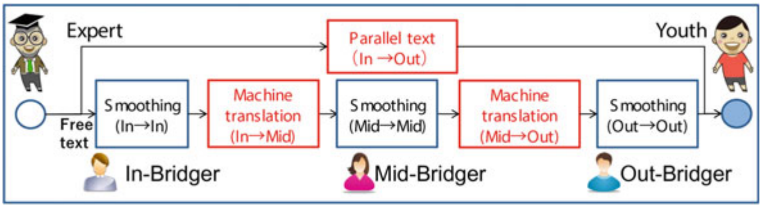

Fig. 2 Translation flow in YMC (In: input language, Mid: middle language, Out: output language)

The Bridger who is responsible for the input language is called In-Bridger. The In-Bridger's role is to edit the Expert's original text into machine-translator friendly text by correcting typographical errors and splitting long sentences into smaller sentences to achieve higher translation quality. This editing process of the In-Bridger is called smoothing. Mid-Bridger, who is responsible for the pivot language, refines the machine translation output of In-Bridger's smoothed text. English is the intermediate language in many cases. The Out-Bridger, who is responsible for the output language, rewrites the machine translation result of the Mid-Bridger's smoothed text to enhance fluency and add youth friendly expressions.

4 Implementation

4.1 Overview of YMC System

YMC System was implemented as a Web-based application written in the PHP programming language. Users access the system from PC web browsers. Youth can access from cell phone web browser only when they submit field data to the system. System diagram is shown in Fig. 3. Analog materials called YMC Tools, which are described later, are also shown in the system diagram to show the whole view of the project. Information shared among Youth and Expert via the YMC System is shown in Fig. 4.

4.2 User Interface

In the YMC System, in order for Youth to post a question message, question category is selected first, and then the corresponding question parallel texts are shown from which one or more can be selected as shown in the left of Fig. 5. These operations need only mouse clicks. On the other side, Expert composes an answer message by using both/either answer parallel text and/or free text in the YMC System as shown

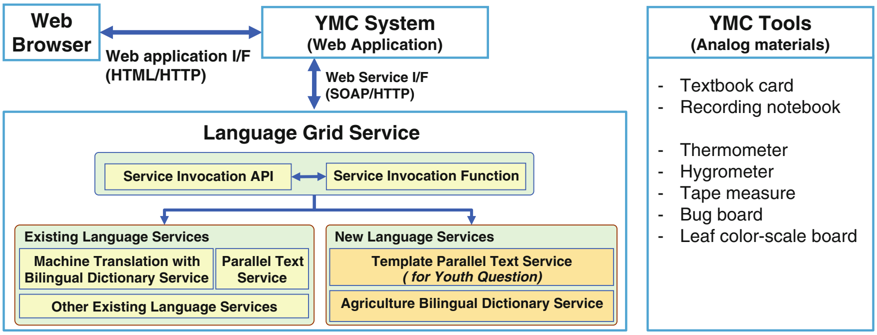

Fig. 3 System diagram of YMC system and YMC tools

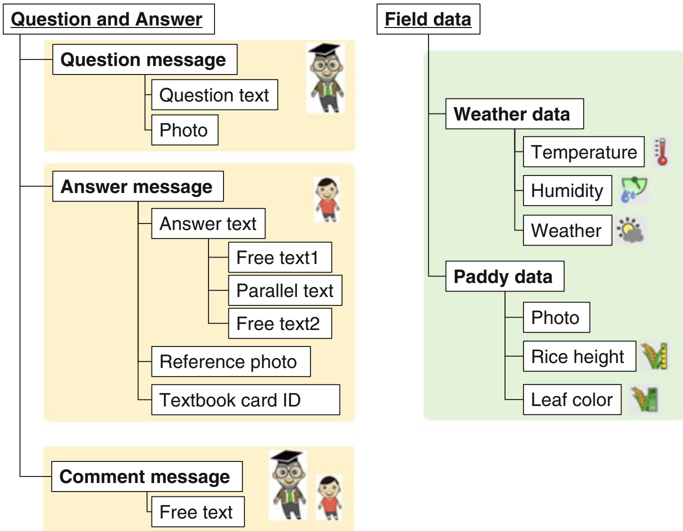

Fig. 4 Shared information among youth and expert in YMC system

in Fig. 6. More than two answers can be combined when necessary. The In-Bridger, Mid-Bridger, and Out-Bridger smooth the answer message. Back translation results are shown in the Bridger's screen for comparison with the original text and back-translated texts to confirm the translation quality. The In-Bridger also adds reference IDs of the related Textbook cards to the answer messages as well as related photos when necessary as supplemental information. Only after the smoothing process is finished by Out-Bridger can Youth see the answer message as shown in the right of Fig. 5.

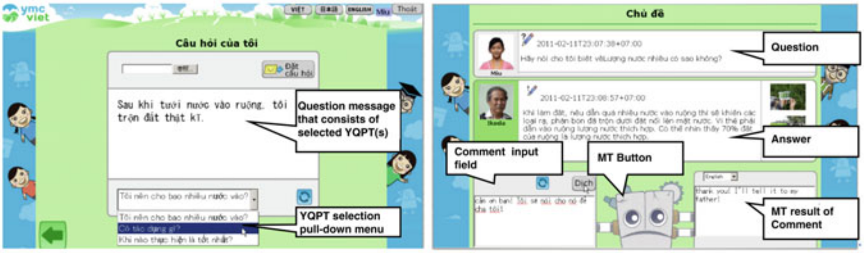

Fig. 5 A screenshot of question input page (left) and answer view page (right)

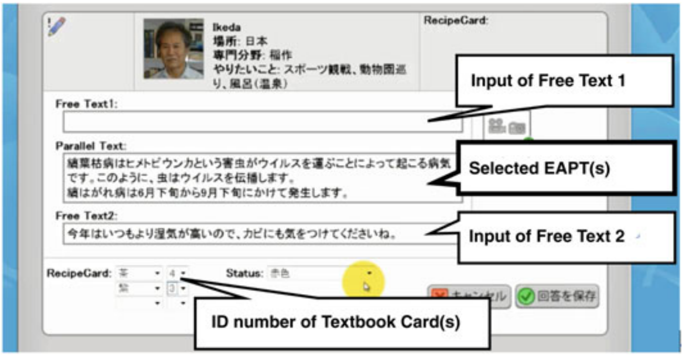

Fig. 6 A screenshot of expert answer composition page

4.3 Language Services

In order to improve machine translation quality, machine translation was combined with multilingual dictionaries using the Language Grid service [4, 5, 12]. The Agrovoc Dictionary, the Rice Dictionary, and the YMC Community Dictionary were linked. The Agrovoc Dictionary has 58,577 agriculture technical terms in English and Japanese, and the Rice Dictionary has 441 rice farming technical terms in English, Japanese, and Vietnamese. Both are existing dictionaries created by third-parties. The YMC Community Dictionary has 2514 entries in English, Japanese, and Vietnamese. It was constructed by our experiment team based on project-related words and includes YMC Tools, names of stakeholders, popular youth words, agriculture words found in parallel texts, and so on. Words were added during the preparation phase and even the experimental phase.

Two types of parallel text, Expert Answer Parallel Text (EAPT) and Youth Question Parallel Text (YQPT), were also prepared. Both have English, Japanese, and Vietnamese word equivalents. EAPT was prepared in order to reduce the loads placed on Experts in composing answer messages to Youth. It is a general agriculture knowledge database in the rice farming domain with 932 entries such as "Big, fat and dense grain is good as seed rice." It is used when Experts compose answer messages in the YMC System. YQPT was prepared to support Youth in composing question messages and accurately deliver the intention of the question to Expert. It is a database with 1904 entries (question texts). All parallel text entries belong to one of the YMC Categories and are used for resource development management as well as parallel text searches of the YMC System. YMC Category is about rice farming domain and the experiment and has a three-layer hierarchical structure; 184 categories were defined by the experiment members, especially Experts.

4.4 YMC Tools: Analog Materials

Prior to the field experiment, YMC Tools such as Textbook cards and Recording notebook to support Youth in the experiments were prepared. Youth were also supplied with a tape to measure rice height and a cell phone to field data to the YMC System and take photos of the crop and paddy. Textbook cards are paper-based cards that show rice farming knowledge visually. Youth take them home and use them in explaining the Expert answer to their parents as shown in Fig. 7. Each Textbook card explains a specific knowledge topic such as rice diseases and pesticides. Each Textbook card belongs to an agriculture category and is color-coded and given an ID number. Expert answer message may include, for example, "Please take the Red-7 Textbook card home." For the experiment, 41 kinds of Textbook cards were prepared.

Each participating Youth was given a Recording notebook intended as an observation diary of his/her parents' rice field. The Recording notebook has preprinted tables for recording temperature, humidity, rice height, and leaf color. It also has "rice calendar" tables to hold the dates of farming processes such as rice seeding,

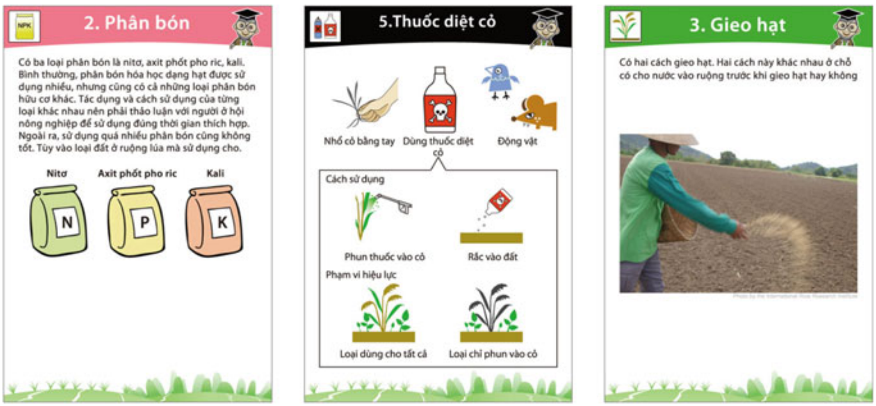

Fig. 7 Examples of textbook cards

fertilizer use, harvesting and so on. Youth is expected to enter the field data into the Recording notebook. There are also interview sheets that Youth fills out indicating what knowledge his/her parent would like to get from Experts.

5 Field Experiment

5.1 YMCViet Project

YMCViet project was conducted with the cooperation of Vietnamese central and local governments, a team of agricultural Experts in Japan, and Bridger teams in Japan and Vietnam. It lasted four months, starting from December 2011 in Thien My commune, Vinh Long province, Vietnam. 30 youths from 29 farmer households, aged from 8 to 15, participated in the experiment. During the experiments, 378 questions were posted by Vietnamese Youth and 378 questions were answered by Experts via the YMC System. 303 of the 378 answer messages had a reference to a Textbook card.

In the experiment, Youth was active in the home, rice field, and YMC Center. First, Youth interviewed his/her parents or family members at home on what they would like to ask Experts about rice farming. Youth took entered the responses into an interview sheet page of Recording notebook. Youth measured temperature and humidity at home and sent the data together with weather information from his/her cellphone every day. He/she visited the family's rice field once or twice a week to measure rice height and leaf color as well as checking for insects; the information was written down in the Recording notebook. In the rice field, he/she took photos of the rice plants and field with his/her cell phone as shown in the left of Fig. 8. Youth visited the YMC Center once or twice a week and accessed the YMC System via computer as shown in the middle of Fig. 8. He/she used Recording notebook entries when sending the field data such as rice height and leaf color, and posted questions to Expert of the YMC System. Youth could read the Experts' answer about a week after the question was posted. Youth could reply to Expert by sending a comment message. Youth also wrote down the answer in the Recording notebook as shown on

Fig. 8 Using YMC system in YMC center (left), taking photos at rice field (center), and writing down an expert answer in the recording notebook (right)

the right of Fig. 8, and took home Textbook cards indicated in the Expert answer, from the YMC Center. At home, Youth checked the Expert answer/message in Recording notebook and explained it orally to parents by showing photos or illustrations on the Textbook cards.

5.2 Evaluation

We evaluate the field experiment with regard to *Problem 1* to *Problem 5* in Table 1. *Problem 6* is not discussed here because it is not related to the design of language services; Togami et al. discusses this in detail [14].

Problem 1 We designed the translation flow to combine parallel texts and free texts. Because it is translated by humans in advance, translation quality of parallel text is guaranteed. The free text is refined by the Bridgers to improve translation quality. We set five levels of translation quality (5: includes all information, 4: includes most of the information, 3: includes a lot of the information, 2: includes only some information, 1: no information). According to Lin et al., the translation quality of Japanese-Vietnamese machine translation is 1.36 [9]. On the other hand, the evaluation result of translation quality in the field experiment was 4.34. (Eleven Vietnamese sentences, which were randomly selected from the Expert Answer message log data of the experiment, were evaluated by four Vietnamese subjects.) Therefore, the proposed translation flow yielded translation quality that was good enough to include "most information" of the original sentences.

Problem 2 The average turnaround time, delay between the time of posting a question and the time of getting an answer, was 107.2 h (SD: 72.28). In addition, 98.7% (373 out of 378) of the responses were returned within a week (168 h). However, the YMC system failed to cover emergencies such as infectious diseases. In the experiment, the disease of rice blast was observed. In such case, spraying the appropriate agricultural chemical would quickly save the crop, but the delay between disease observation and Expert response was too long.

Problem 3 We introduced the role of the Bridgers, people who refined Expert answer messages so that Youth could more readily understand. All communication logs among all 265 responses were analyzed excluding answers of only example parallel translations and corrections of example parallel translations among the 378 responses, Bridger smoothing was mainly applied to expressions that were easy for children to understand. There were 47 modifications and 16 suggestions of interactivity. Out of the 378 Expert answer messages logged, 265 messages contained free texts. Of these 265 Expert answer messages, 47 messages were refined by the Bridgers for easier understanding by Youth. Sixteen messages were Bridger modified in order to facilitate interaction between Expert and Youth. The modifications made to enhance Youth understanding can be characterized as summarizing, adding supplemental knowledge, and simplifying redundant expressions. As one example, Bridger added the general recommendation "You should not put fertilizers outside, because fertilizers are degraded by rain, wind, and sunlight" at the beginning of an

Expert original answer message consisting of five sentences. Bridger added some supplemental knowledge when the Expert answer lacked full information, or when the Expert answer had difficult technical terms. For example, Youth questioned "Rice stems are bitten. Who bites them?", and Expert answered, "If the lower part of the rice stems are bitten, it is probably by rats." Bridger added "It is necessary to deal with the situation appropriately according to its cause." to suggest action was needed. Also, Bridger added example expressions so that Youth could understand well. On the other hand, to facilitate interaction, Bridger added greeting messages such as "Hello, XXX" and comment messages such as "Your question is interesting." According to an interview of Bridgers, these personal sentences were added because they wanted to facilitate social communication and thus develop a good relationship with Youth.

Problem 4 After selecting the question category, we proposed and introduced a question input method to combine multiple example translations composed of sentence fragments by mouse operation to create question texts. We proposed and introduced the new question input method for Youth so that they could create question texts by combining multiple fragments of bilingual parallel texts by mouse operation without keyboard input. The experts were able to answer all questions from the children. Meanwhile, an interview of Youth who participated in the experiment found that some wanted to use free text for question input, because their search for parallel texts failed or was ineffective. YMC System allows Youth to send free text messages by using the comment input field. According to the log data of the experiment, 86 free text comments were posted. Two of them were questions to Expert and the remaining 84 comments were greetings and gratitude expressions.

Problem 5 In order to support Youth in transferring information to their parents at home, we proposed and introduced Textbook cards that Youth could take home from the YMC Center. In the field experiment, 303 (80.2%) of the Expert answer messages included a reference to one or more Textbook cards. Also, after the experiment, we submitted a questionnaire to all 30 Youth and asked "Please choose what you think is useful (multiple answers allowed)." The choices were six items such as "posting questions via YMC System," "explanation to parents by Textbook cards," "field survey observation," "temperature and humidity measurement." As a result, ten Youth answered "explanation to parents by Textbook cards," followed by "posting questions via YMC System" by 12 respondents which is the most answered item. In the questionnaire, Youth were also asked "Why do you think so?," and they answered such as "Because I can clearly explain to my parent what I got from Expert with Textbook cards" and "Because I can tell my parents how to raise rice."

6 Conclusion

The experiments in this chapter exemplified the difficulty of intercultural communication between people with different levels of subject matter expertise and proficiency in different languages. First, a communication environment with language services was designed to investigate the Youth Mediated Communication method. The design combined multilingual text information with peripheral data feedback, visual information, and paper-based materials. Second, a communication system was implemented to provide language services. The combination of parallel text and free text input contributed to decrease the loads placed on the Japanese rice farming experts. Finally, a field experiment was conducted. The target was rice farming households in the Mekong Delta, Vietnam; 30 youths from 29 local households participated. The evaluation of the experiment verified the positive effect of the communication system, though some issues remain. For example, the system was unable to identify and respond to emergency situations.

According to the Ministry of Agriculture and Rural Development of Vinh Long province in Vietnam where the project took place, the average rice yield of participating farmers was 0.3–0.5 tons per hectare larger than that of non-participating farmers in the area (Average yield in the area was 6.8 tons per hectare). In addition, due to the reduction in pesticide use, which was suggested by Expert, rice production cost decreased, while the rice yield increased. Thus, the revenues of participating farmers increased. This verifies the positive effect of the project in agricultural support.

Acknowledgements The field experiment in this research was funded by the Ministry of Internal Affairs and Communications, Japan, as part of its interest in Information and Communication Technology model projects in three priority areas in developing countries called "Ubiquitous Alliance Project." This research is partly supported by Service Science, Solutions and Foundation Integrated Research Program from JST RISTEX and a Grant-in-Aid for Scientific Research (A) (17H00759, 2017–2020) from Japan Society for the Promotion of Science (JSPS).

References

1. Climent, S., Mor, J., Oliver, A., Salvatierra, M., Snchez, I., Taul, M., Vallmanya, L.: Bilingual newsgroups in catalonia: a challenge for machine translation. J. Comput.-Mediated Commun. **9**(1) (2003)
2. Fruchter, R.: Conceptual, collaborative building design through shared graphics. IEEE Expert Intell. Syst. Appl. **11**(3), 33–41 (1996)
3. Fruchter, R., Clayton, M.J., Krawinkler, H., Kunz, J., Teicholz, P.: Interdisciplinary communication medium for collaborative conceptual building design. Adv. Eng. Softw. **25**(2), 89–101 (1996). Computing in Civil and Structural Engineering. http://www.sciencedirect.com/science/article/pii/0965997895001069
4. Ishida, T. (ed.): The Language Grid: Service-Oriented Collective Intelligence for Language Resource Interoperability. Springer Science & Business Media (2011)
5. Ishida, T.: Intercultural Collaboration and Support Systems: A Brief History. International Conference on Principle and Practices in Multi-Agent Systems (PRIMA 2016). Invited paper, pp. 3–19 (2016)
6. Jiang, H., Singley, K.: Exploring bilingual, task-oriented, document-centric chat. In: Proceedings of the ACM 2009 International Conference on Supporting Group Work, GROUP '09, pp. 229–232. ACM, New York (2009)
7. Lin, D., Ishida, T.: Participatory service design based on user-centered qos. In: Proceedings of the 2013 IEEE/WIC/ACM International Joint Conferences on Web Intelligence (WI) and Intelligent Agent Technologies (IAT) - vol. 01, WI-IAT '13, pp. 465–472. IEEE Computer Society, Washington, DC (2013)

8. Lin, D., Ishida, T.: User-Centered Service Design for Multi-language Knowledge Communication, pp. 309–317. Springer, Tokyo (2014)
9. Lin, D., Ishida, T., Murakami, Y., Tanaka, M.: Qos analysis for service composition by human and web services. IEICE TRANS. Inf. Syst. **97**(4), 762–769 (2014)
10. Lin, D., Murakami, Y., Ishida, T., Murakami, Y., Tanaka, M.: Composing human and machine translation services: language grid for improving localization processes. In: Proceedings of the Seventh International Conference on Language Resources and Evaluation (LREC'10), pp. 500–506. European Language Resources Association (ELRA), Valletta (2010)
11. Mori, Y.: Youth Mediated Communication Model: New Challenge to Bring Youths for Better World. Phase i Agriculture. Asia-Pacific Advanced Network (APAN2009) (2009)
12. Murakami, Y., Lin, D., Ishida, T.: Service-Oriented Architecture for Interoperability of Multi-language Services, pp. 313–328. Springer Berlin Heidelberg, Berlin (2014)
13. Tanaka, R., Murakami, Y., Ishida, T.: Context-based approach for pivot translation services. In: IJCAI, pp. 1555–1561 (2009)
14. Togami, T., Ninomiya, S., Yamamoto, K., Mori, Y., Takasaki, T., Okano, Y., Ikeda, R., Takezaki, A., Kameoka, T.: Field and weather monitoring with youths as sensors for agricultural decision support. Agric. Inf. Res. **21**(3), 65–75 (2012)
15. Wu, H., Wang, H.: Pivot language approach for phrase-based statistical machine translation. Mach. Transl. **21**(3), 165–181 (2007)
16. Yamashita, N., Ishida, T.: Effects of machine translation on collaborative work. In: Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work, CSCW '06, pp. 515–524. ACM, New York (2006)