

Chapter # 20

WHAT CHATBOT SHOULD SUPPORT NOVICE INSTRUCTORS IN ASSISTING STUDENTS IN PBL PRACTICE

Akiko Kai¹, Yuriko Ishida², & Ryuichi Matsuba³

¹*Institute of Information and Media, Aoyama Gakuin University, Japan*

²*Faculty of Human Resources Development, Polytechnic University, Japan*

³*Faculty of Business Administration, Fukuyama Heisei University, Japan*

ABSTRACT

"Reflection-Bot" is a chatbot originally designed for daily journaling in self-directed language learning, with features that promote goal setting and reflection through personalized notifications. In the present paper, we explore the potential of utilizing this chatbot for students' weekly learning supports in a PBL course through an analysis of interview data from several new instructors. The results highlight various issues with the PBL course as currently practiced, such as inadequate instructional time for students, lack of intervention training for instructors, and underestimation of the importance of intervention. We show that if we add to the existing chatbot the ability to intervene for students' learning on behalf of instructors or to show instructors how to do that could potentially solve some of the issues.

Keywords: project-based learning, self-directed language learning, reflection of learning, chatbot.

1. INTRODUCTION

1.1. Question-Prompting Chatbot for Self-Directed Learning

It becomes crucial in global language policies to promote Self-Directed Learning, here and hereafter SDL (Knowles, 1975), and leverage assistive technologies. SDL requires students to possess a variety of learning readiness (e.g. Guglielmino, 1978; Stockdale & Brockett, 2011; Oddi, 1987), among which identifying learning needs, setting goals, selecting strategies, and evaluating outcomes are important elements. Many universities in Japan offer training programs to help students become better learners during their first year of study (e.g., Matsuba et al., 2023). The objective of the programs is to cultivate learners' readiness for SDL, with a particular emphasis on fostering their ability to set and reflect on learning goals.

Because second language acquisition is a complex and long-term process, it is essential to build the learner's independent study that is skills. To achieve personal goals, Japanese language learners need to develop the ability to set their own objectives, select relevant materials, and define learning pathways. Providing structured guidance alongside opportunities for independent, self-directed learning under instructor supervision can significantly impact learners' future learning positively. However, the lack of comprehensive guidelines to support their development makes it challenging for instructors to provide sufficiently effective guidance to learners.

The lead author and her coworkers are conducting educational developmental research in order to establish an activity model for Japanese as a second language courses at the university level. This Self-Directed Language Learning (SDLL) model is designed to enable

students to naturally engage in SDL and develop these skills for continued success in their future learning endeavors (Kai, Matsuba, Goda, Wada, & Suzuki, 2020). The SDLL model was designed and refined based on a Design-based Research framework (McKenney & Reeves, 2019), includes practicing Japanese outside classroom, journaling about the experience, and engaging in reflective activities within classroom. We examined the design requirements and proposals for the activity, created a skeleton design, and developed the supporting tool. For learners of Japanese as a Second Language, the language is an integral part of their daily lives. The need to learn and practice Japanese naturally arises from everyday experiences. Consequently, setting specific goals should be guided by reflections on their daily language use. In SDLL model, learners break down their learning goals into achievable weekly tasks during the course and create weekly objectives and plans. They are required to record the outcomes of their efforts, ideally daily but at least three times a week. At the beginning of the next module, the learners go over their weekly logs and reflect on their progress. Then, they discuss with peers about their reflections or consult with instructors to improve their plans for the next week. Our learners give a formal presentation at the midterm and end of the semester to share their self-evaluations of how effectively they carried out their learning plans and met their learning objectives. This model is based on the diary method, which is considered an optimal approach for fostering reflection and goal setting (Brandt, 2020). We recognize the approach to be effective in supporting this type of SDL. The most challenging aspect of this activity for the learner is keeping a consistent daily diary. (e.g., Saito, Miyake, Fukushima, Suzuki, & Imai, 2009).

In recent years, chatbot systems with various features have been actively employed in many educational fields like language learning and nursing in higher education to meet the needs of students in the fields (e.g., Fryer, Nakao & Thompson, 2019, Studente & Ellis, 2020). However, initial implementation results revealed that a standalone portfolio system hardly encourage learners to maintain daily records. To improve the effectiveness and feasibility of this activity model, Kai et al. (2020; 2024) also employed a chatbot system, and developed an original "Reflection-bot" system to support the continuous recording of learning experiences. Two key aspects emphasized during the system's design phase are to lower the barriers for learners to journal their learning experiences, and to provide reminders they would not forget to do so. We adopt "LINE" system (<https://line.me/en/>) as the platform for "Reflection-bot." "LINE" is one of the most popular communication applications in East Asia, which holds nearly 100% market share among Japanese university students. We expect that incorporating a chatbot into the social networking platform most familiar to learners and allowing them to write entries using the same user interface would greatly improve accessibility. In addition to simplifying the process for students to submit reflections on the LINE social networking platform, this solution integrates LTI (Learning Tools Interoperability) to store these entries in a LMS (Learning Management System) at the same time. Thus, it successfully accomplishes two goals: giving students an easy-to-use method to write entries and allowing them to see their records through the LMS in class, which eventually helps them build a thorough learning portfolio.

The "Reflection-bot" implements the function of sending a series of questions predetermined by an instructor to their learners ("What was the most impressive thing you learned today", "Why", etc.) and recording their responses. Instructors can use a web-based administrator settings page to customize the chatbot's question items and set other features. Once configured, the chatbot can be distributed to learners, who register it in their LINE accounts by scanning a QR code. In order to address the need for providing reminders, the chatbot features customizable notifications, letting learners set own timing. It is the unique feature among similar systems. By allowing learners to choose when they receive prompts,

the system smooths the transition from notification to recording. It keeps a balance between respecting and encouraging learner autonomy while providing the structure necessary for consistent and thorough documentation. The study for empirical validation of the system has indicated the ability to vary notification times for each learner. It not only holds higher rates of continuous record-keeping, but also expands the ability to conduct meaningful reflective activities based on the records that lead to improvement of their own goals consequently (Kai et al., 2020). To evaluate the applicability of our activity model and design principles with this chatbot, we have carried out it in a university introductory Japanese language course. As a result, we confirm that learners' reflections and goals became more specific and clearer (Kai et al., 2024). In parallel, with the evolution of generative AI, Kai and Wada (2023) implemented a parameter setting function for generative ChatGPT into the chatbot, which also enables us to output comments corresponding to learners' input. In this way, the chatbot continues to be developed to support an enhanced SDL experience.

1.2. Purpose of the Present Study

We assume that the unique chatbot described above can be used for goal-setting and reflection help in a variety of sectors, in addition to language acquisition. It has been demonstrated that the chatbot created by Kai et al. (2020; 2024) is quite successful at gathering reflections on daily learning experiences and carrying out weekly meta-reflections. Its capacity to facilitate learning activities over a longer time frame, such keeping track of weekly activities and carrying out meta-reflections on a semester basis, hasn't been adequately assessed, though. Thus, our goal is to investigate how this chatbot can facilitate other educational types of weekly activities. As a first step in our study, we conduct an exploratory survey to newly hired instructors of PBL (Project-Based Learning) courses.

2. METHOD

2.1. Survey Subject

During the various weekly activities, this study focuses on PBL as it incorporates multiple aspects of SDL. We consider that the approach described above also works beneficially in PBL, an increasingly popular teaching method worldwide (Ishida & Matsuba, 2019; Guo, Saab, Post, & Admiraal, 2020). In PBL, students are required to set project themes and goals, which necessitates the ability to define their own learning objectives. As the project progresses, the students need to create schedules and divide tasks, demonstrating autonomy in planning and execution. Additionally, PBL requires the students to independently search for necessary information and select appropriate resources. After the project concludes, the students are also commanded to evaluate their outcomes and reflect on the process. Thus, PBL involves stages of planning, preparing, learning, reflecting with the students expected to actively manage these stages. This makes PBL a learning model that supports SDL. For the students become proficient in SDL, instructors can provide assistance if the students are not yet fully independent. To track each student's progress and reflective thinking, instructors typically have the students write reflections after each activity of the PBL practice (Waguri, 2010). However, instructors often encounter reflections of less-than-ideal quality. The instructors sometimes do not take feedback on these reflections seriously and simply mark them as "READ". This slight lapse, in addition to student dissatisfaction, can lead to a decline in the quality of the reflective writing more. We predicted that the primary reason for this situation is the scarcity in both quality and quantity of reflective records, which are essential for effective tutoring in student goal setting and project

progression. We consider the situation could significantly improve by introducing our activity model with our chatbot, which would enable students to produce more meaningful reflections. This, in turn, could enhance the quality of tutoring and subsequently improve students' learning outcomes.

The common activity between self-directed language learning model mentioned above and PBL is to write reflections on the set goals. We conducted this exploratory study with the help of newly hired instructors affiliated with a college of KOSEN (National University of Technology in Japan) offering a large-scale PBL program annually, because we hope to know what pedagogical interventions provided by novice instructors in the PBL practice when they firstly engaged, as well as the challenges they faced, in order to support SDL (Ishida, Takeoka, Kajimura, & Matsuba, 2018). It is expected that the study can not only reveal the intervention methods that the instructors use to assist their students and the challenges they face in doing so but also clarify the potential of chatbots in supporting the setting of learning goals and reflection in PBL practices. In the rest of this section, we briefly introduce the PBL program offered at the college of KOSEN.

The offering program is mandatory for all students from the 2nd to the 4th grade across four departments: Mechanical Engineering, Electrical and Computer Engineering, Urban Systems Engineering, and Architecture, with a total enrollment of approximately 500 students. The students usually take three distinct projects for six semesters, or three years, until they graduate. They are grouped into diverse teams across grades and departments, then work on selected year-long projects under an instructor's guidance in the program. They are not allowed to choose their team, but they can voluntarily choose the project theme they will work on in this program. There are about 60 teams in all, and each team has one support instructor. The support instructors are not expected to oversee their students' activities in-depth or provide them with task instructions. Rather, the instructors are supposed to offer educational interventions in response to requests from their students or when they notice a specific need among the team members.

Each semester consists of three phases: Orientation, Main Activities, and Wrap-up. During the orientation phase, the students engage in activities designed to understand the course structure and get to know their team members. In this phase, the instructors first provide a lecture on the course objectives, the activities to be undertaken, expected outcomes, and key personal achievements. The achievement goals outlined in the syllabus are 1) to be able to self-regulate, 2) to work in own teams while respecting others, and 3) to be able to collect and organize information, identify issues, and make proposals. At the beginning of each semester, the students set individual goals, aligned with these achievement goals (autonomy, collaboration, and creativity), which are evaluated throughout the course. At this point, the support instructors review students' self-set goals and action plans. Then if they need a guidance for their students, they have a closed meeting with the students to provide it and request revision of the outcomes. Subsequently, the students define their team's theme tackled through two semesters. The theme is strongly required to meet the following conditions: it should benefit someone, pose a challenge for the team, and align with one of the 17 Sustainable Development Goals usually noted as SDGs. After setting theme, the team members are assigned own roles and make an action plan for the semester.

In the final phase of each semester, the students critically reflect on their performance with a rubric for self-assessment. The rubric is organized around three major objectives, each divided into three specific criteria, totaling nine criteria, which include goal-setting and reflection. They evaluate their performance on each criterion using a five-level scale, from Level 0 (lowest) to Level 4 (highest). Additionally, for each major objective, the students select one criterion they particularly wish to focus on and create an action plan outlining the

steps they will take to achieve this goal. These aids like rubrics or self-reflection sheets empower them to critically analyze own performance, aligning their understanding and skills with the course objectives.

2.2. Collected Data

A report containing verbatim transcripts from an interview survey conducted with novice instructors at the college of KOSEN (Ishida, Mizushima, Tanaka, Suzuki, & Matsuba, 2024) was selected as the appropriate data source for this analysis. This data, provided by the second author, who implemented the survey, was obtained in accordance with the provisions of the GDPR, and all data has been anonymized for analysis. There are no ethical concerns.

2.3. Survey Procedure

The purpose of the interview was to explore how newly hired instructors assist students in setting goals, implementing projects, and reflecting on students' progress. Written explanations concerning the survey objectives, data handling, and related matters were provided in advance to all new instructors in their first to third year of teaching PBL at this college of KOSEN, and six instructors agreed to participate. The interview was conducted through pre-surveys via Google Forms and semi-structured interviews in November and December of 2022, coinciding with the wrap-up phase of the second semester of the year. The pre-survey questions were organized in a chronological order to help participants recall the content of their teaching practices, following the PBL process. The pre-survey included the following question items:

[Orientation phase]

- ☞ Do you believe that students improved their ability to set and reflect on goals?
- ☞ At which phase did you intervene with advice or guidance in this course?
- ☞ Did you have students set personal goals (in the first or second semester)?
- ☞ Did you provide advice, and guidance, or require revisions during the goal-setting phase?
- ☞ Did you encourage the use of a workbook during the goal-setting phase?

[Main Activities phase]

- ☞ What strategies did you employ to facilitate smooth learning activities for the students?
- ☞ Did you instruct students to write weekly reflection sheets?
- ☞ How frequently did you review the content of the student's reflection sheets?

[Wrap-up phase]

- ☞ Were you able to conduct interviews with the students at the end of the first term?
- ☞ How much time did you spend on interviews per student?

The interviews were based on the contents of the pre-survey to further investigate these topics. The interviewees were interviewed for about 90 minutes each. First, they were asked whether they had taken actions such as encouraging students to read the workbook at each stage. If there were interventions, the interviewers inquired about the specifics of the intervention, the use of resources or aids provided (worksheets, senior instructors, etc.), and the outcomes of such interventions. If there was no intervention, the reasons for not intervening were explored. They were also asked about any overall challenges or issues faced. Additionally, to understand the instructors' values, the perceived frequency of the need for advice and guidance was also discussed. With the transcribed interview data, the second author, who is most familiar with the college of KOSEN's PBL, performed the primary content analysis aligned to this research objectives and extracted relevant parts related to the subject matter. Subsequently, the other authors reviewed the data and conducted analyses from the perspective of this study, shared their results, and adjusted the criteria for judgment in case of disagreements. Due to the small amount of data, inter-rater reliability coefficients were not calculated for the purpose of evaluation adjustments.

3. RESULTS

We present below the results of our analysis of the hearing investigation. It was found that most of the instructors were not actively intervening in students' goal setting and reflection. Time constraints and lack of knowledge about intervention methods were cited as the main reasons. Some instructors also complained that students set low self-evaluations.

Three of the interviewees reported that they can observe the growth of their assigned team members for goal setting and writing reflection. All interviewees were instructed to set personal goals for the students in their charge during the orientation phase, and four of them used the workbook to do so, but only one interviewee stated that she used the workbook effectively to provide specific guidance to her team members. We asked the instructors, who did not give any advice to their students, the reasons for this. The responses indicated that some of them felt unable to intervene at an early stage when they did not know their students well or did not recognize the need for advice and guidance regarding their students' personal goals. One respondent expressed frustration over his students' tendency to set goals below their actual capabilities. In response to a question about planning team projects, half of the interviewees implemented some form of intervention particularly focused on building relationships among team members and assigning roles. Other respondents except one provided some advice or a guidance at the very least. The reasons for offering the advice included the goals not meeting established criteria, the potential for future challenges if students failed to reach a consensus, and the advisability of planning activities in advance when coordinating with fixed-date college events, such as a college festival. Other interventions at the first stage were primarily related to team building, like ice-breaking activities and senior students guiding the juniors. Three respondents instructed their students to complete reflection sheets weekly during the main activities. However, only one consistently reviewed the reflection sheets. The other two respondents reviewed the sheets only at the end of the term, while the remaining three did not review them at all.

It was illustrated that the reasons why they provided for not utilizing the reflection sheets as follows:

- ☞ Although the benefits of completing the reflection sheets were explained during the orientation phase, I would not check the content, leaving it to the students to decide whether to use them. Based on observations during the classes, it seemed that likely none of the students were writing them.
- ☞ There was neglect in reviewing the reflection sheets.
- ☞ As the hands-on work became more intensive, finding time within the class to complete the reflection sheets became hard.

Another common intervention included asking about the activities and outcomes at the end of each week (5), providing encouragement when activities were stagnant (5), and encouraging active participation from students (4), where the number in parentheses is the number of respondents. All six respondents had individual meetings with their students in the summary phase. The average meeting time was around 9 minutes, ranging from 5 to 15 minutes, with the most common duration being 10 minutes. The focus of the consultations was to convey evaluations from the team members and from the instructor. As we conclude this section, we show some characteristic comments about challenges or difficulties identified in the interviews:

- ☞ Finding it challenging to guide senior students who believe they are performing well.
- ☞ Finding a loosening of the students' tempers around the second month of the first semester.

- ☞ Struggling to determine the appropriate level of control an instructor should exert in this course, which emphasizes student autonomy.
- ☞ Deciding on intervention methods when progress stalls.
- ☞ Noticing a tendency for compromise among senior students who are taking the course for multiple times.
- ☞ Wondering how I should suggest students who intentionally give low self-evaluations at the beginning to produce growth.

4. DISCUSSION

The purpose of the present study was to identify teaching practices and issues faced by novice teachers engaged in a PBL practice as a preliminary step to examine whether our chatbots used in daily Japanese SDL activities can be applied to PBL with weekly activities for a semester-long. There are some common learning activities between Self-directed Language Learning (Kai et al., 2024) and PBL like writing reflections on set goals. We identified through the interview data a shared challenge in both educational practices is the issue of students not consistently writing reflections. When instructors require students to write reflections outside of class due to limited class time, some may forget to complete the task. Simply assigning it as an out-of-class activity is also unlikely to solve the problem of superficial or incomplete reflections. While we judge the simply adjusting notification function to a weekly schedule does not fully resolve the above issue, the user-friendly writing interface and reminder feature designed in our chatbot could be part of the solution to mistake for continuous journaling at least.

The interview data indicate that there is little of active intervention of the instructors during the PBL practices, despite the instructors recognize a lack of improvement in this ability among students. This finding corroborates our initial hypothesis presented at the outset of the paper. Almost all the participants of the interviews indicated that their lack of time is the reason they did not or could not provide educational interventions during the progress of their students' projects. Nevertheless, they have consistently fulfilled their responsibilities, such as supporting students in setting learning goals at the beginning and meeting with them at the end of the term. In addition, all, except for one individual, have been able to intervene as needed, such as managing their time and encouraging their active participation since the orientation phase. It would not be difficult to find enough time for instructors to encourage students to write reflections, so we do not doubt that there are other causes for the lack of active educational intervention. We interpret the data as indicating that new the instructors are willing to try to intervene in simple tasks and problems that are easy to commit to through previous experience, but tend to be hesitant to commit to students because of a lack of effective intervention methods or poor understanding of learning processes such as "goal setting and reflection". Another probable explanation for the neglect of "goal setting and reflection" is the small number of teachers, unfortunately including some senior faculties, recognize the value of developing this ability. It substantiates the perspectives that, as we show above, the instructors' statements about uncertainty for the scope of the intervention and that the students intentionally provide low self-assessments.

It is easy to assume that the reluctance of the new instructors due to their inexperience would be improved by emulating the interactions with students of experienced adepts that is senior instructors. As part of the support for the new instructors, the program assigns a senior instructor to be present in the same room to continuously address questions and clarifications in the college program. In addition, there is the PBL practice guidebook including templates for each student activity developed by the program administrators and made available to all

assigned instructors (National Institute of Technology Akashi College Active Learning Center, 2022). The document is a compilation of the overall course flow, learning activities and the role of the instructors based on the findings of learning science research and the knowledge of the administrators, i.e. the experienced instructors. The interview data points out that they appear to receive advice from the experienced instructors to the same classrooms as required, but not to the extent of actively imitating the adepts. Despite having access to the guidebook, the new instructors are not fully utilizing the formats, like the weekly reflection sheet even though they are aware of their existence. The underutilization of these resources suggests not only the possibility that the provided aids may be insufficient, but also that instructors may not perceive them as valuable enough to use. From the present study, we found that new instructors are not able to make good use of resources based on the knowledge possessed by the adepts, i.e., proficient instructors. One of our challenges for the future is how to promote the transfer of knowledge from the adepts to newcomers and how to implement the education of the newcomers.

Do you think whether our chatbot can improve these situations for the new instructors or not? As you can be easily predicted, most of the issues described so far can be attributed to the inexperience of the new instructors in PBL practice. The introduction of a chatbot for student supports in PBL practice is expected to solve many issues caused by inexperienced instructors at a certain level. We envisage that the chatbot's support will guide both students and instructors in three key areas. The first direction is 'Goal Setting and Reflection,' where the chatbot helps students set clear and achievable goals. The key here is to provide questions that allow the students to reflect on the phases of the project in their reflections each time. Second, a chatbot intervenes on behalf of the instructor at each predefined milestone in the program, such as determining the team's theme, creating a team activity plan, and so on. In response to the chatbot's intervention, the instructor assists the students solve their problems, which also encourages relationship-building between the instructor and the students. The last direction is the use of the chatbot in creating the instructor's coaching portfolio. PBL practice, as we discussed before, requires instructors to have coaching skills rather than teaching skills. It is anticipated that the most effective method for skill acquisition is for instructors to improve their coaching skills through self-coaching during practical training in a PBL program. We are confident that both instructors and students will recognize the importance of enhancing this capability through 'goal setting and reflection.'

5. CONCLUSION

In the present paper, we have investigated the potential of the chatbot originally designed for language learning to broader applications in SDL settings and, particularly explored the challenges instructors faced in implementing educational interventions during different practical phases in a PBL framework. Objectively, we argue that the issues identified here are generalizable and applicable to any organization that implements PBL practices. Many of instructors, especially the inexperienced, lack coaching skills for intervention effectively in goal setting and reflection. They tend to rely on personal educational beliefs rather than on systematic and logical methods based on the rules set forth by the program management team or the results of learning science research. We suggest that the reluctance of new instructors due to inexperience can be improved by emulating the behaviors relate with students of experienced seniors. If we provide sharing successful case studies and insights via an ICT system, i.e. chatbot, could quickly enhance their intervention capabilities.

The study identifies three main issues: instructors' failure to recognize the need for educational interventions, uncertainty about the appropriate intervention methods for each phase of the students' activities; and the challenge of finding sufficient time for effective intervention. In the college of KOSEN practice explored here, the students of the program are required to monitor the progress of their projects and reflect on their personal growth. Time constraints, unfortunately, make it difficult for instructors to provide adequate intervention, and, as a result, they end up having to prioritize teaching over other activities. Facilitating reflection and ensuring instructors have access to students' reflective records before class can help in preparing effective intervention strategies. However, it is also true that such analysis and planning is time-consuming, and some technical assistance is acquired to reduce the burden on instructors. We expect that our proposed chatbot will play a major role in solving the issue. The system will help students keep track of their activities, both in and outside of class, so that they can easily access the recorded information whenever they need it.

We expect that the improvement of the functionality of our chatbot by integrating it with the instructional case database so that it can also be used as an instructional support chatbot. It would be useful for instructors in charge of PBL practice, especially newcomers, to develop their own student support skills in practice by creating a coaching portfolio as we showed before. We also consider that the system will not only allow the instructors to propose pedagogical interventions when supporting PBL projects, but also serve as a thought-provoking, or reflective, interlocutor for their portfolio work. As usual, such instructor interventions are optional and often limited to those with sufficient time and motivation. To encourage more proactive engagement, the institution could formalize these interventions and require outcome reporting, while ensuring this process doesn't overly burden instructors. It is essential to foster intrinsic motivation by showcasing the positive impact of interventions through instructor exchanges and student feedback. If the chatbot can collect students' reflective records and refer to similar cases in the case database to suggest appropriate interventions, instructors can then use these suggestions for their educational interventions. The outcomes of these interventions can be fed back into the database as new insights, creating a beneficial cycle. Such a cycle is essential for enhancing instructors' motivation by providing them with practical, evidence-based strategies for intervention. We recognize the need for this positive feedback loop and will continue to consider enhancements to our chatbot's functionality to facilitate this process.

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AUTHORS' INFORMATION

Full name: Akiko Kai

Institutional affiliation: Institute for Information and Media, Aoyama Gakuin University

Institutional address: 5-10-1 Fuchinobe, Chuo-ku, Sagamihara, Kanagawa 252-5258

Biographical sketch: Akiko Kai is an assistant professor at the Institute of Information and Media, Aoyama Gakuin University in Japan. She is teaching Japanese as a second language and coordinating the Learning Commons. Her research interests include Self-Directed Language Learning, Technology-enhanced Learning, and Instructional Design.

Full name: Yuriko Ishida

Institutional affiliation: Faculty of Human Resources Development, Polytechnic University

Institutional address: 2-32-1 Ogawa-Nishi, Kodaira, Tokyo, 187-0035

Biographical sketch: Yuriko Ishida is an assistant professor at Polytechnic University, Japan. Her major field is educational technology and career development. Her research interests include Learner-centered instruction and Career Consulting in vocational training.

Full name: Ryuichi Matsuba

Institutional affiliation: Faculty of Business Administration, Fukuyama Heisei University

Institutional address: 117-1 Kami-Iwanari, Miyuki-Cho, Fukuyama, Hiroshima, 720-0001

Biographical sketch: Ryuichi Matsuba is a professor at Fukuyama Heisei University, Japan. His major field is educational technology. In his charrier he mainly engages in support learners in both technologically and humanly. For a decade, he has enjoyed to study ePortfolio implementation, particularly interested in how to effectively learn with ePortfolio. In addition, he has considered about a next generation personal learning environment in order to support life-long continuous learning. His recent interests include what learners need to be trained in his/her university education to acquire Self-Directed Learning skills, and what learning experiences can help them acquire the skills.