Construction and evaluation of an integrated formal/informal learning environment for foreign language learning across real and virtual spaces

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Abstract. This paper presents the prototype of a foreign language learning space, based on the construction of an integrated formal/informal learning environment. Before the background of the continued innovation of information technology that places conventional learning styles and educational methods into new contexts based on new value-standards, environment models of foreign language learning constantly face the necessity to change. A structured environment for foreign language learning can be created only when the learning environment in the real space, which is constructed in many forms outside the classroom, constantly connects with the formal learning environment inside the classroom. This study assumes two axes of a learning environment – formal/informal and real/cyber space – and attempts to integrate them to create a circulating four-dimensional model. Integrating formal and informal environments connects real space, which depends on the physical location and situation, with cyber space, which does not. In this study, sentences written in a foreign language by language learners will be auto-collected and analyzed in cyber space, which plays a great role in students' daily lives. Thus, a 4D foreign language learning environment, which automatically delivers practical knowledge to the learner by a comprehensive analysis of formal and informal learning between real and cyber space, will be constructed.

Keywords: informal learning, foreign language learning, 4D foreign language learning environment.

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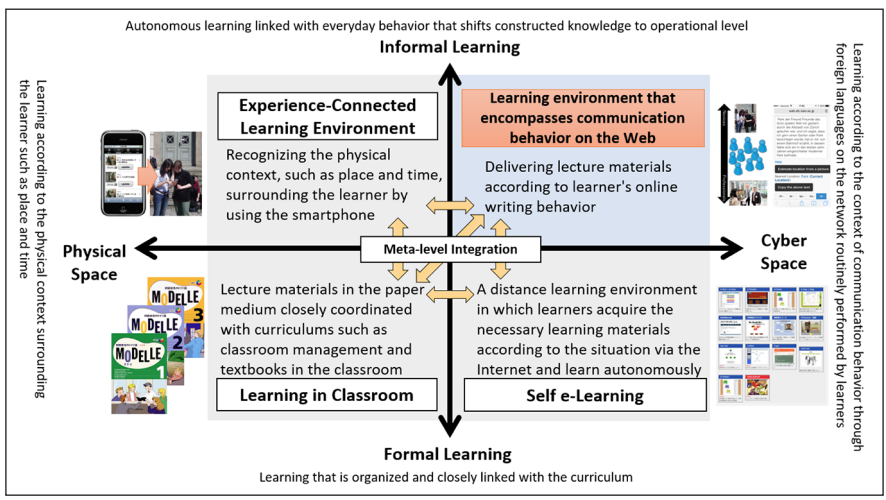
1. Introduction

In the field of foreign language education, the important issue is, how to bridge the gap between learning activities inside the classroom and learning activities outside of it. Foreign language learning environments are constantly changing together within the learners' daily lives, increasing the need not only to revise the formal learning space, but also the whole structure of the learning environment. From the perspective of foreign language learning, practice in the field is the most important space for linguistic 'output'. Therefore, it is necessary to examine the daily situation of learners − in 'real' space as well as in 'cyber' space.

The relevance of bridging both spaces is pointed out in studies on mobile learning, where it has been shown that connecting the formal learning in the classroom with learners' real-life experiences can be supported with smartphones detecting the learners' locations and supplying them with multimedia content that matches their real-time situation (Waragai, Kurabayashi, Ohta, & Raindl, 2012).

This study is carried out before the long-term background of our continuous experiments. At the Keio University Shonan Fujisawa Campus (Japan), researchers and educators have been working on designing computer-based language learning environments to provide language learners (mainly of German) with learning opportunities outside the classroom that are linked to classroom content (Waragai, Ohta, Raindl, & Kurabayashi, 2013; Waragai et al., 2014).

Figure 1. 4D foreign language learning environment



This paper is focused especially on writing activity in a foreign language. It is often argued that mobile learning has the potential to connect formal learning and informal learning experiences (Kukulska-Hulme & Sharples, 2016). Also, the prototype of a Mobile Language Learning Environment (MLLE) shows that "the use of the loci method mapping with mobile devices might lead to changes in learning awareness and an expansion of strategy knowledge" (Waragai, Raindl, Ohta, & Miyasaka, 2016, p. 462). Results from a recent study show that handwritten feedback is more effective compared to e-feedback (Elwood & Bode, 2014). In this study we locate the writing dimension in cyber space among the four dimensional spaces (Figure 1).

2. System design

A recent study presented a software which enables the recording of writing processes by gathering keystroke data (Kusanagi, Abe, Fukuta, & Kawaguchi, 2015). Our approach introduces a smart foreign language writing editor that integrates paper-based classroom learning and digital device-based independent learning. We have developed a foreign language learning system as a smartphone web application. This learning environment offers a novel image-based learning support mechanism that associates the knowledge acquired in a classroom with the current context of writing text. This system analyzes statistical features of the text to calculate the similarity between the current text and the previously reviewed writing assignments, showing the most relevant material in order to assist learners in ways that increase their language learning awareness.

Figure 2. Image of the system design

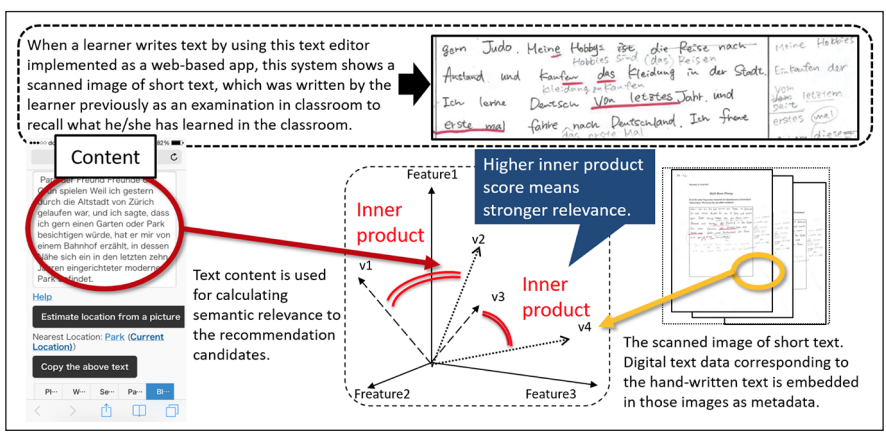


Figure 2 shows an architectural overview of our system. When a learner writes using this system, he/she is shown a scanned image of short texts which were previously hand-written by the learner during class, in order to recall what he/she has learned in the classroom. The scanned images of the short texts include metadata that contain digital text data corresponding to the hand-written text. The system calculates semantic relevance between the typed text and the scanned images by using this metadata. This system consists of two modules: (1) a text analysis module and (2) a semantic relevance calculation module. The text analysis module generates n-gram text statistics, which is a contiguous sequence of *n*-items from a text. For example, 2-gram sequence of the text 'apple' is 'ap', 'pp', 'pl', and 'le'. This sequence represents a statistical feature of 'apple' by decomposing the text into primitive sequences. The semantic relevance calculation module measures how words, sentences, paragraphs are appropriate to a user by calculating content-based similarity between the currently inputting text and the scanned images. We can calculate the relevance of two texts by using n-gram as follows:

$$\text{relevance}(q,t) \coloneqq \sum_{i=0}^{n} (q_i \cdot t_i)$$

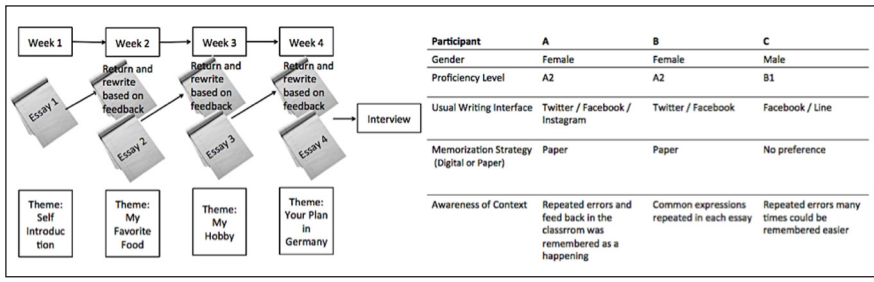
Where q and t denotes n-gram statistics of given text, qi denotes i-th primitive of n-gram of text q, and t_i denotes i-th primitive of n-gram of text t. The system shows the most relevant scanned image by using the calculated score. This context-aware recommendation helps the learner to express his/her daily-life experiences in a foreign language. In addition, this system gives special weight to the last word, referring to the word that the user entered last, and the current word, referring to the as yet incomplete word that the user is just typing.

3. Discussion

This project is targeting three participants of a German skill course at Keio University. None of them have any experience of staying abroad for an extended period of time. All of them have learned English as second language. The experiment for this pre-survey carried out in a class focused practicing of writing skills. Figure 3 shows the process of the experiment focusing on the writing process (left) and the interview data of the three participants in order to evaluate the process (right). In total they have written four essays (one per week) on four different topics. Each essay was corrected with comments and rewritten by the learners during class. After this four week process, we have interviewed

the participants. The questions were focused on how they have memorized the mistakes they corrected.

Figure 3. Experiment and evaluation of the writing process



Participant	A	B	C
Gender	Female	Female	Male
Proficiency Level	A2	A2	B1
Usual Writing Interface	Twitter / Facebook / Instagram	Twitter / Facebook	Facebook / Line
Memorization Strategy (Digital or Paper)	Paper	Paper	No preference
Awareness of Context	Repeated errors and feed back in the classrrom was remembered as a happening	Common expressions repeated in each essay	Repeated errors many times could be remembered easier

4. Conclusion

The interviews showed that learners' memories are connected not only with the memories about their grammar or expression errors, but more closely with what happened in the classroom (Participant A and B). This relates mostly to the communication with the educator according to the feedback during class. Participant C paid more attention to the errors, which he felt he had repeated many times. For the three participants, the handwritten error-correction of the essay was more impressionable than digital correction by Microsoft Word. It could be seen that errors are easier to remember when shown visually. When writing an essay, the memory of prior mistakes seemed to remain in visual form rather than as knowledge. The conclusions that can be drawn from the experiment and the interview data of only three subjects are certainly limited. However, this study could be continued by the following steps: a test run with the developed system and consideration of the method of how we can provide a holistic systemized learning environment for language learners.

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