Abstract: Described here is a computer-based system of learning Japanese. It offers three types of problems in learning the language; basic sentential pattern practices, counting drills, and kanji-kana mixture writing exercises. The system is generative. We first generate Japanese sentences using the English alphabet, i.e., phonetic representation. We then create from the sentences a sequence of problems for the students of Japanese to practice. In the current implementation, the kana and kanji writing problem seems to serve the educational purpose most effectively, as it is crucial to master Japanese and, at the same time, seems to be the most fun, as the students like it best.

Keywords: Language learning, Japanese, System, Sentence generation, Kana/kanji characters

INTRODUCTION

Japanese is said to be a difficult language to learn. However, its basic sentential structures are simple and pronunciations are rather easy, as it has fewer phonemes than most other languages. The difficulties lie in its highly inflected forms of verbs, auxiliary verbs, and adjectivals, how these forms are combined to express certain modalities (three modes of expressing the same thing: humble, polite, and honorific ways), and multiple ways of writing the same linguistic sound sequence: kana, kanji, and their mixed forms.
This paper describes a language learning system for students of Japanese. The system tries to serve educational aims by offering drills to practice basic sentential patterns (in word inflections and counting problems), and the standard Japanese writings in *kana* and *kanji* mixed forms.

**OVERVIEW OF THE SYSTEM**

The control structure of the system is simple. It first shows a menu from which the student chooses a problem area to study. It then generates a sentence and creates a problem, in the chosen area, for the student to practice. Figure 1 shows the control structure. In the outer loop, the student practices problems from different areas. In the inner loop, the system alternates generating a sentence and creating a problem in the area the student has chosen, until he or she quits the exercise. Below, we show kinds of problems the system covers at this writing.

**Sentence Patterns.** The system generates a basic sentence, and asks the student to transform it to a specified form. For instance, it may generate the following sequence:

*watashi wa gakkou ni iku.*
(I got to school.)

Past:

*watashi wa gakkou ni itta.*
(I went to school.)

The student is supposed to change the present tense to the past:

*FIGURE 1 Control Structure*
Counting Things.
The system generates a sentence that contains a countable noun, and then creates a problem in which the student is to supply a suffix to the number that expresses the quantity of the countable noun. For example:

\( \text{koko ni enpitsu ga } 3 \text{ ( ) arimasu} \).
(Here are 3 pencils.)

Answer:

The student should supply "bon" as the answer for this problem; "hon" happens to be the suffix for counting pencils, but the answer to the problem above must be "bon," for when "hon" is attached to the quantity 3, a phonetic change for "hon" to "bon" occurs, i.e., the pronunciation is changed.

Writing Practices.
In this drill, the student tries to learn Japanese writing with \textit{kanji} and \textit{kana} mixed forms—difficult, yet an important exercise in learning to write standard Japanese. The system first changes the sentence generated in English alphabet to \textit{kana} form and then puts some portions in parenthesis. The student is supposed to change the parenthesized portions to \textit{kanji} characters:

\( \text{koko ni hon ga 2satsu arimasu} \).
(Here are 2 books.)

Since the standard keyboard without word processing facility is not capable of inputting \textit{kanji} characters, the student is to write them down in his or her notebook. Then, by hitting the return key, the system gives the right answer, which for this example is:

\( \text{koko ni 本が 2 個あります} \).

SENTENCE GENERATION

Some 30 years ago, the computer seemed to generate sentences at will.\(^2\) However, it turned out that it wasn't really generating, but transforming sentences, using simple pattern matchings. The original sentences were supplied by the user who wanted to talk to the computer. How far have we come since then? Now, we may be able to deal with sentences in elegant ways in computational grammars, language generation systems, and cognitive science (see footnotes 3, 4 and 5). But we still have a problem of producing a range of sentences that are also semantically realistic in daily life. When in an example a grammar is able to produce:

\( \text{watachi wa depa-to e kaimono ni iku} \).
(I go shopping to a department store.)

it will also generate:

\( \text{watashi wa honya e kaimono ni iku} \).
(I go shopping to a bookstore.)

which is a bit funny, and:

\( \text{watashi wa yuugijyou e kaimono ni iku} \).
(I go shopping to a game center.)
which is unacceptable. But then:

\[ \text{watashi wa } \{ \text{ depa-to } \quad / \ honya \quad / \ yuugijyou \} \ e \ shuukin \ ni \ iku. \]

(I got to a department store/bookstore/game center to collect the money.)

are all acceptable sentences. We have not yet seen any elegant solutions for controlling these problems.

Our system generates sentences from which fresh drill problems are produced. We use sentential patterns for the sentence generation because they are correct and realistic, both semantically and syntactically.

**Sentential Patterns.**

Basic Japanese sentences are formed with a number of noun phrases, followed by a verb or an adjectival.

\[
\begin{align*}
\text{[NP, ...]} & \ V. \\
\text{[NP, ...]} & \ \text{ADJ.}
\end{align*}
\]

Each noun phrase takes a role or case associated with the particular state or action the verb or adjectival expresses. The cases are marked explicitly by particles or postpositions attached to the nouns. Consider the following sentences:

\[ \text{watashi wa shinbun o yomu.} \]

(I read a newspaper.)

\[ \text{sono hana wa akai.} \]

(That flower is red.)

Here, *yomu* is a verb, *watashi* (1) is an agent, and *wa* is the agent marker; *shinbun* (newspaper) is an object, and *wo* is the object marker; *akai* (red) is an adjectival, *hana* (flower) is an object, and *wa* is the object marker. Since the role of a noun phrase is expressed explicitly, the order of noun phrases in a sentence may be arbitrary most the time in Japanese. Thus, we can say:

\[ \text{shinbun wo watashi wa yomu.} \]

(I read a newspaper.)

Sentences in our system are generated using sentential patterns for common verbs and adjectivals. In addition to these patterns, we let the system stock other basic patterns we commonly use in daily life. A few examples of each type are shown below.

We use a kind of BNF notation to express the patterns. The elements enclosed by two brackets are optional, and those enclosed by two braces are alternative terminals. The description between two slashes indicates the restrictions imposed for applying the rule. "..." in the right hand of a rule indicates "etc." The non-terminals not rewritten further are word categories in the dictionary we use.
Verb Patterns

iku [<person> wa [<from> kara] <to> {e | ni} [<means> de] [<accompany> to] [<time> ni]]
<person>:= <person name> | <personal pronoun>
<from>:= <go place>
<to>:= <go place> / not equal to <from> /
<means>:= <transportation> | <aruite> / eliminate case marker for <means> when aruite is chosen /
<accompany>:= <person name> / not equal to <person>/
<time>:= <clock time> | <time adverb>
<clock time>:= [gogo | gozen | hiro no | voru no]
<hour> ji [choudo | han | <minute> fun]
<time adverb>:= <time adverb> / change the verb to past form for the time adverb indicating past/
<hour>:=<integer> / from 1 to 12/
<minute>:= 51101151...155 / if the number is even, change fun to pun.
<integer>:= <digit> | <digit> | <integer>
<digit>:= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0

iku [<person> wa [<accompany> to] <*1> ni] / <accompany> not equal to <person>/
<*1>:= eiga [wo mi] | asobi | kaimono

itte ruku [<person> wa [<from> kara] <to> {e | ni} [<means> de] [<accompany> to] [<time> ni]]

suku [<person> wa <v002> ga] / always add desu to this verb /
<*2>:= <food> | <pronoun> | <person name> | <sports> | <proper noun>
<proper noun>:= <person name> | <proper noun>

dekiru [<person> wa <*3> ga]
<*3>:= <academic subject> | <sports>

yomu [<person> wa <*4> wo]
<*4>:= shinbun | zasshi | hon | manga | koukoku
Adjectival Patterns.

$muzukashii$ [<academic subject> $wa$ [<academic subject>] $yori$]]
/second <academic subject> not equal to the first/

$muzukashii$ [<demonstrative> **1> $wa$]
**1>:= hon | ji | mondi | toi

takai [ **2> $wa$ [**2> $yori$]]
**2>:= <vegetable> | <fruit> /choose both of **2> from the same
category and the second **2> not equal to the first /

Basic Patterns.

[<pronoun> $wa$ **3> desu [ne]
**3>:= <flower> | <food> | <general object>

**3> $wa$ <pronoun> desu [ka]

desu [<time adverb> $wa$ [<month> $gatsu$] [<day> | <weekday>] youbi]
$month$:= <integer> /from 1 to 12/

desu [<person> $wa$ <profession>]
A sentence is generated by picking up one of these patterns and selecting appropriate terminals (words or phrases). The noun phrases may be commuted. Thus, examples from the first pattern for *iku* include:

> watashi wa gakkou e iku.
> anata wa gakkou e 3ji ni iku.
> watashi wa eki ni yamadasan to iku.

> kare wa eki ni aruite iku.
> Yamadasan wa kyoukai ni kinou itta.

(past)

> kanojo wa honya ni kuruma de Hanakosan to gog 2ji 30pun ni iku.

etc.

**Dictionary.**
We use a dictionary that contains words (and some phrases) according to the following categories:

```plaintext
<word category> := <verb> | <nouns> | <adjectavs> | <adverbals> | <personal name> | ...
<nouns> := <proper noun> | <go place> | <pronoun> | <demonstrative> | <personal pronoun> | <transportation> | <academic subject> | <sports> | <profession> | <food> | <flower> | <vegetable> | <school name> | <railway> | <general object> | <firm name> | ...
<adjectavs> := <adjectaval> | <tasetel> | <size> | <colorl> | ...
<adverbals> := <adverbal> | <time adverb> | ...
<person name> := <name> [<person suffix>]
```
Each verb entry contains a verb with its end form, followed by its stem, type of inflections, kana representation, kanji representation, and typical modifiers it may take. Japanese verbs have five different types of inflecting patterns, each taking six different linking forms to other words (mostly to auxiliary verbs). For example, the verb iku changes its forms to:

watashi wa gakkou e...
(I go to school.)

(a) i-ka, i-ko
(b) i-ki
(c) i-ku (end form)
(d) i-ku
(e) i-ke
(f) i-ke (imperative form)

The changes occur going through an entire line (ka, ki, ku, ke, and ko) of a column of the 50 basic sounds (ten columns by five lines). We classify the words that have this inflecting pattern as V5.

An adjectival's entry contains an adjectival with its end form followed by its kana representation and kanji representation. Adjectivals have two different inflecting patterns. See Table 1, V5 for examples of a verbal inflection pattern, and A1 for an adjectival inflection pattern. We note here that there are verbs of V5 that change forms through other columns in the 50 basic sounds.

Nouns in Japanese would not change forms. A noun entry contains a word, and its kana representation, kanji representation, modifiers it may take, and number suffix, if it is countable. An adverbial entry contains a word, followed by its kana representation, kanji representation, and the tense it indicates, if any.

We separated <person name> from other nouns just for convenience. An entry for the person's name and its suffix contains a word, followed by its kana representation, kanji representation, and gender. Figures 2a-2d show a few dictionary entries in each category.

**PROBLEM GENERATION**

**Word Inflections.**

Verbs, adjectivals, and auxiliary verbs are inflectible words in Japanese, and take one of the six forms when combined with other words in a sentence. Verbs take five different inflecting patterns; adjectivals take two; and auxiliary verbs take ten or so, depending upon how they are classified. Any word belonging to the inflectables changes its form in the six different ways that are shown in Table 1. A difficult challenge in forming sentences is to use auxiliary verbs with the same and/or different category of words, and to inflect the inflectables properly.

Once a basic sentence is generated, we can add one or more auxiliary verbs to the verb or the adjectival in it and change its modalities. A verb having the inflection pattern of V5
<table>
<thead>
<tr>
<th>Col.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>V5</td>
<td>ka</td>
<td>ka</td>
<td>ki</td>
<td>ku</td>
<td>ku</td>
<td>ke</td>
<td>k, ko i-ku</td>
</tr>
<tr>
<td></td>
<td>ga</td>
<td>ga</td>
<td>gi</td>
<td>gu</td>
<td>gu</td>
<td>ge</td>
<td>ge, go oyu-gu</td>
</tr>
<tr>
<td></td>
<td>sa</td>
<td>sa</td>
<td>shi</td>
<td>su</td>
<td>su</td>
<td>se</td>
<td>se, so o-su</td>
</tr>
<tr>
<td></td>
<td>ta</td>
<td>ta</td>
<td>chi</td>
<td>tsu</td>
<td>tsu</td>
<td>te</td>
<td>te, to u-tsu</td>
</tr>
<tr>
<td></td>
<td>na</td>
<td>na</td>
<td>ni</td>
<td>nu</td>
<td>nu</td>
<td>ne</td>
<td>ne, no shi-nu</td>
</tr>
<tr>
<td></td>
<td>ba</td>
<td>ba</td>
<td>bi</td>
<td>bu</td>
<td>bu</td>
<td>be</td>
<td>be, bo to-bu</td>
</tr>
<tr>
<td></td>
<td>ma</td>
<td>ma</td>
<td>mi</td>
<td>mu</td>
<td>mu</td>
<td>me</td>
<td>me, mo no-mu</td>
</tr>
<tr>
<td></td>
<td>ra</td>
<td>ra</td>
<td>ri</td>
<td>ru</td>
<td>ru</td>
<td>re</td>
<td>re, ro no-ru</td>
</tr>
<tr>
<td></td>
<td>wa, a</td>
<td>wa</td>
<td>i</td>
<td>u</td>
<td>u</td>
<td>e</td>
<td>e, o suku-u</td>
</tr>
<tr>
<td>A1</td>
<td>karo</td>
<td>kat</td>
<td>ku</td>
<td>i</td>
<td>i</td>
<td>kere</td>
<td>tadashi-i</td>
</tr>
</tbody>
</table>

**TABLE 1**

Inflection Patterns of Verbs and Adjectivals

**FIGURE 2a**

Verbals and Adjectival Entries
<table>
<thead>
<tr>
<th>Proper Noun</th>
<th>Japanese</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calico</td>
<td>か berhasil 山</td>
<td>successful mountain</td>
</tr>
<tr>
<td>Tokyo</td>
<td>とうきょう 山</td>
<td>Tokyo Mountain</td>
</tr>
<tr>
<td>Go places</td>
<td>かっこ 市; 学校: personal pronoun no ... eja; eja; personal pronoun kore; are; demonstrative hono; ano; personal pronoun watashi; kore; hiro; ひと 人; demonstrative; kara; hiro; kara; demsha; academic subject saigaku; shakaizuku; opera; yakyou; tenyu; profession: zakkai; kaihashi; food kare; soba; sushi; sukiyaki; vegetable daikon; tamato; fruit; ringo; meji; ro; railway keikyu; chuoamen; school name tokyou; deron; school name japan; firm name hitachi; sony; general object; kompyueta; enbi; manu</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2**

New Entries
may take the auxiliary verbs, *u*, *nai*,
*tai*, *reru*, *ta*, and *masu*, and change the
modalities of the sentence, as is
shown below in the case of *iku*.

watashi wa...

(a) *iku*+*u* —> *iko-*u.
   (I will go.) (will)
(b) *iku*+*nai* —> *ika-*nai.
   (I do not go.) (negation)
(c) *iku*+*tai* —> *iki-*tai.
   (I wish to go.) (wish)
(d) *iku*+*reru* —> *ka-*reru.
   (I can go.) (can)
(e) *iku*+*ta* —> *it-*ta.
   (I went.) (past tense)
(f) *iku*+*masu* —> *iki-*masu.
   (I go.) (polite expression)

Other inflection patterns of verbs may take the same or different types of auxiliary verbs to express the modalities. We can express other modalities with other auxiliary verbs, and complex modalities with certain combinations and defined order of more than one auxiliary verbs. Some examples of complex modalities are:

watashi wa...

(g) *iku*+*masu*+*nu* —> *iki-*mase-*n.
   (I do not go.) (polite negation)
(h) *iku*+*nai*+*ta* —> *ika-*nakat-*ta.
   (I did not go.) (negation+past)
(i) *iku*+*masu*+*nu*+*desu*+*ta* —> *iki-*mase-*n*+*deshi-*ta.
   (I did not go.) (polite+negation+past)
A much more involved example is:

*kare wa...*

(j) *iku+ta+i+desu+u* \(\rightarrow\) *iki-takat-tadesho-u.*

((I assume) he might have wished to go.)

Table 2 shows a part of modality patterns we keep for our system; Figure 3 shows a part of auxiliary verbs, and Table 3 shows examples of inflection forms of two auxiliary verbs. In Figure 3 the information associated with each auxiliary verb is its *kana* representation and type of word it may take with the specific inflection form, if the word is inflectable (this part is repeatable, if the auxiliary takes more than one type of words). For example, *u* takes verb of V5 and the adjectivals of A1 types, both with the first inflection form (e.g., *iku+u*). Other unexplained symbols used here represent the following: I (Inflectables), N (Nouns), VS (verbs with inflecting pattern S), S (Stem).

The system generates a basic sentence and then chooses a modality pattern. All the information needed to connect the words in the pattern and other inflectables is found in the dictionary and the tables. Take a simple example:

*kono mondai wa muzukashii.*

(This problem is difficult.)

(past):  

Table 2 shows that we should use *ta* for the past tense. The dictionary entry for *ta* tells us that this word is connectable to the second form of the inflectables. From the entry for *muzukashii*, we understand that the adjectival belongs to the inflection type A1. Then, Table 1 indicates that the second form of the adjectival is formed by adding *kat* to the stem of the adjectival. The result of the transformation therefore is:

*kono mondai wa muzukashikatta.*
### TABLE 2 Modality Patterns

<table>
<thead>
<tr>
<th>Modality</th>
<th>Types and Order of Aux. Verbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>will</td>
</tr>
<tr>
<td>2</td>
<td>negation</td>
</tr>
<tr>
<td>3</td>
<td>wish</td>
</tr>
<tr>
<td>4</td>
<td>can</td>
</tr>
<tr>
<td>5</td>
<td>past</td>
</tr>
<tr>
<td>6</td>
<td>polite</td>
</tr>
<tr>
<td>7</td>
<td>6, 2</td>
</tr>
<tr>
<td>8</td>
<td>2, 5</td>
</tr>
<tr>
<td>9</td>
<td>6, 2, 5</td>
</tr>
<tr>
<td>1</td>
<td>u, you</td>
</tr>
<tr>
<td>2</td>
<td>nai, nu</td>
</tr>
<tr>
<td>3</td>
<td>tai</td>
</tr>
<tr>
<td>4</td>
<td>reru, rareru</td>
</tr>
<tr>
<td>5</td>
<td>ta</td>
</tr>
<tr>
<td>6</td>
<td>desu, masu</td>
</tr>
<tr>
<td>7</td>
<td>masu</td>
</tr>
<tr>
<td>8</td>
<td>nai</td>
</tr>
<tr>
<td>9</td>
<td>masu</td>
</tr>
</tbody>
</table>

### TABLE 3 Inflection Forms of Auxiliary Verbs

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>nai</td>
<td>nakaro</td>
<td>nai, naku</td>
<td>nai</td>
<td>nai</td>
<td>nakere</td>
</tr>
<tr>
<td>masu</td>
<td>mase, mashi</td>
<td>masu</td>
<td>masu</td>
<td>masure</td>
<td>mase</td>
</tr>
</tbody>
</table>
Counting Problems.
Counting in Japanese is troublesome, because we need to add different types of suffixes to the quantifier. For instance, in English, we say: Here are two pencils. In Japanese, we have to add a suffix to the number.

\[ \text{koko ni 3bon no enpitsu ga aru.} \]

We may use many different suffixes to count things. Figure 4 shows typical ones, each with kana representation and kanji representation.

The system generates counting problems using the sentential patterns such as: (Top figure on facing page.)

Suppose we have a basic sentence:

\[ \text{kyoushuju ni enpitsu ga 3(san)bon aru} \]
(There are 3 pencils in the classroom.)

The system eliminates (san)bon from the sentence, and gives the problem as:

\[ \text{kyoushitsu ni enpitsu ga 3() aru.} \]

Here, other sentences like:

\[ \text{kyoushitsu ni knopyu-ta ga 3dai aru} \]
(There are 3 computers in the classroom.)
\[ \text{niwa ni tori ga 5wa iru} \]
(There are 5 birds in the garden.)

are generated by consulting the dictionary and finding that konpyu-ta uses the suffix -dai, and tori uses the suffix -wa. The problem generation is automatic once we get a sentence that includes a specific number associated with the countable noun.

Kana and Kanji Representations.
Writing Japanese with kana and kanji mixed forms is essential, but difficult to learn. When the system generates the sentence:

\[ \text{yamada san wa eki ni iku.} \]
(Yamada goes to the train station.)

it picks up information from the dictionary: (Bottom figure on the facing page.)
aru [[<***1> ni] <***2> ga [numerals]]
  <numerals>:= <p1> | <p2> | <p3> | <p4> | integer | number suffix
   /choose number suffix according to the second variable /
  <***1>:= heya | kyoushitsu | ... 
  <***2>:= enpitsu | hon | kami | knotpy-ta | kaban | ... 
iru [[<***3> ni] <***4> ga [numerals]]
  <***3>:= doubutsuen | niwa | yama | soto | ... 
  <***3>:= <birds> | <animals> | <profession> | ... 
  <p1>:= 1(ip)pon | 2(ni)hon | 3(san)bon | 4(yon)hon | 5(go)hon | 6(rop)pon
   | 7(nana)hon | 8(hap)pon | 9(kyu)hon | 10(jyup)pon
  <p2>:= 1(hito)tsu | 2(futa)tsu | 3(mit)tsu | 4(yot)tsu | 5(itsu)tsu | 6(mut)tsu
   | 7(nana)tsu | 8(yst)tsu | 9(kokono)tsu | 10(tou)
  <p3>:= <integer> nin /when <N3> takes 1, 2, or 4, use 1(hito)ri, 2(fut)ri,
   4(yo)nin, respectively /
  <p4>:= 1(ip)piki | 2(ni)hiki | 3(san)biki | 4(yon)hiki | 5(go)hiki | 6(rop)piki
   | 7(nana)hiki | 8(hap)piki | 9(kyu)hiki | 10(jyup)piki
Using this information, the system changes the alphabetical form to

parenthesizing kanji portions. Then it asks the student to write the portions in kanji characters. We impose a restriction here that the student is to write them down on a sheet of paper, since, as was mentioned before, the standard keyboard would not allow us to input kanji characters.

**EXAMPLES**

We show a sequence of examples taken from drill sessions. They are rather simple, as we want to give problems that may be understood within the sentential patterns and the information supplied in Figures, Tables, and the dictionary in this paper.

**Inflections.**

**watashi wa gakkou ni iku.**
(I go to school.)

(polite): ikimasu  
***right***

**watashi wa gakkou ni iku.**
(I go to school.)

(negation): ikanai  
***right***

**watashi wa 9 ji ni okiru.**
(I get up at 9:00.)

(will): okoyou  
***right***

**sono hito ha kuru.**  
(That person comes (here).)

(past)+(negation): kinakatta.  
***wrong: konokatta***

In the last example, the second inflection form of nai is nakat (see Table 2), and nai takes the first inflection forms of the inflectables. kuru is a verb of VK type, and its first inflection form is ko, while not exemplified in Table 1.

**Counting.**

**heya ni enpitsu ga 3( ) aru.**  
(There are 3 pencils in the room.)

answer: sanbon  
***right***

**heya ni tsukue ga 2( ) aru.**  
(There are 2 desks in the room.)

answer: nidai  
***right***

**niwa ni gakusei ga 2( ) iru.**  
(Two students are in the garden.)

answer: ninin  
***wrong: futari***

**heya ni kaban ga 3( ) aru.**  
(There are two bags in the room.)

answer: sanko  
***wrong: mittsu***

A thing may be counted in more than one way. For instance, tsu may be used in the counting of bags in the last example. This is not a real problem, however, since more than one suffix may be included in a dictionary entry.
Kana and Kanji Writings.

kyou wa getsuyou bi desu.
(It is Monday today.)
(きょうは 月曜日です。)

enpitsu ga 3bon aru.
(There are 3 pencils.)
(鉛筆が 3本ある。)

watashi wa eki ni kuruma de iku.
(I want to go to the station by car.)
(私は電車で行く。)

watachi wa kyoukai ni kinou itta.
(Yamada went to the church yesterday.)
(わたしたちは きょうかいに きのう いった。)

A problem nicely solved here is the homophonic representations of different words. For instance, in the last example, kinou may be replaced by... when no restrictions are imposed. It should take a time adverb in this sentential pattern, however, and only one kinou is acceptable, which is... We observed that sometimes the student found it very frustrating to be asked to write the same word in kanji over and over again. We are able to avoid this problem if we keep a history of the kanji words being learned in each session.

CONCLUSION

Currently, we use about 250 verbs and adjectivals for the sentential patterns, and slightly more than one thousand words and phrases in the dictionary. The program is written in LISP on a microcomputer. The students like to practice kana and kanji mixed writings the most and it turned out that this practice is fun and educational for the Japanese students, too.

We have found that building a language learning system is not an easy task. When we devise such a system, a lot of effort has to be put into the project, regardless of which direction we take. Our experience tells us that we cannot implement our system too elegantly, for it diminishes practicality. On the other hand, we can not afford to devise an "ad hoc" system, either, for then, no expansions are possible.

The practicality and extensiveness of our system are assured by using sentential patterns and generating sentences. With these mechanisms at hand, we can get realistic sentences that are in textbooks for beginning students of Japanese and fresh problems to practice. We are also able to make the system more versatile by defining new types of problems which work on the sentences generated.
REFERENCES


Author's Address

Teiji Furugori
Dept. of Computer Science
The University of Electro-Communications
Chofu, Tokyo, Japan