Quiz Generation on the Electronic Guide Application for Improving Learning Experience in the Museum

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Many people visit museums.

Museums are places for learning

- Do you have a learning experience in museums?

Many visitors only look at the exhibits vaguely

It is difficult to understand many of the exhibits.
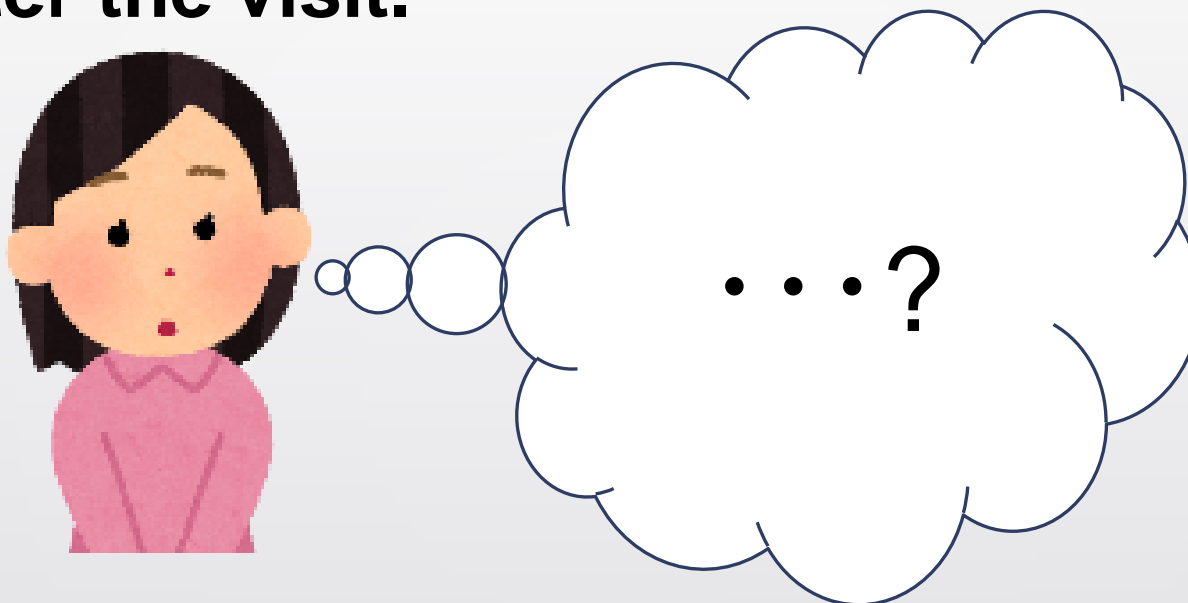

Instruments

Rituals

Dolls

Spirits

Entertainment

Visitors may not remember anything after the visit.

This kind of visit cannot be learned
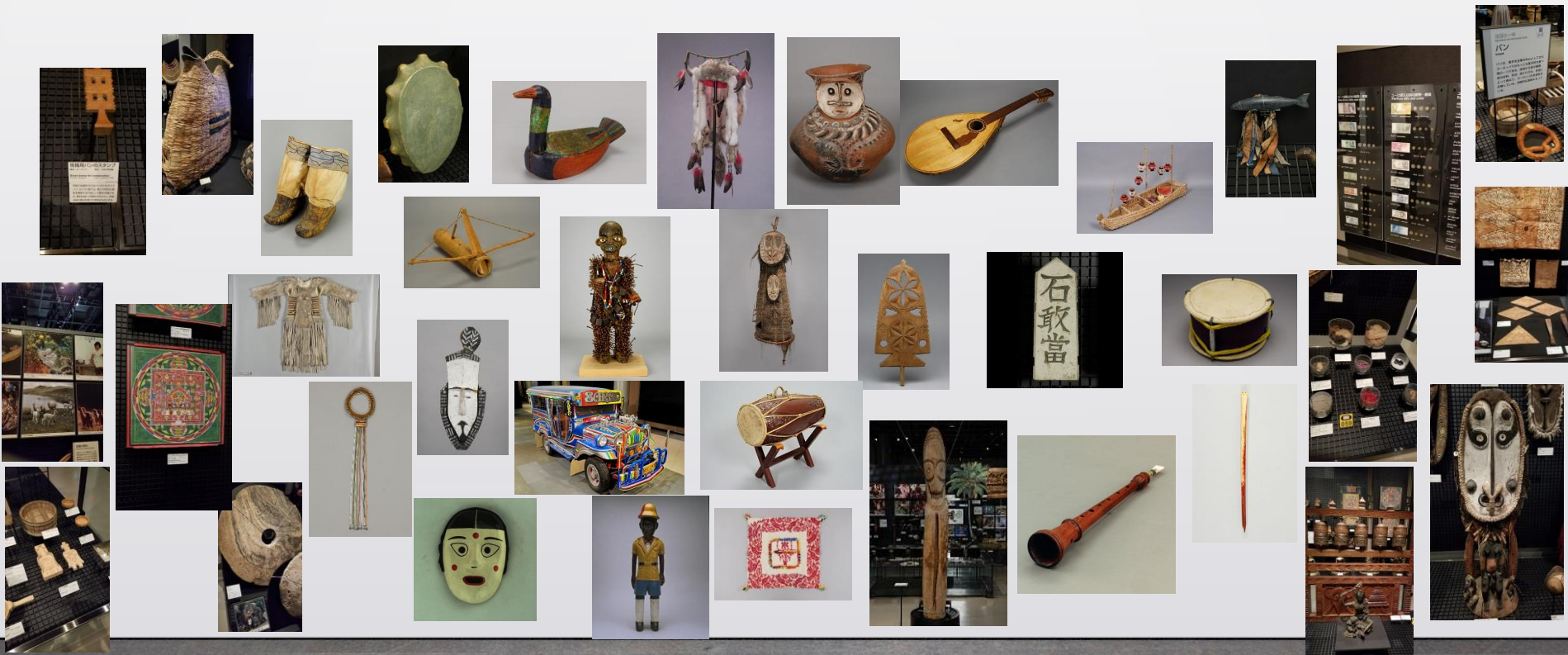
Goal of this research

Improving learning experience of museum visits.

National Museum of Ethnology, Japan (a.k.a. Minpaku)

There are many exhibits at Minpaku, about 12,000 items

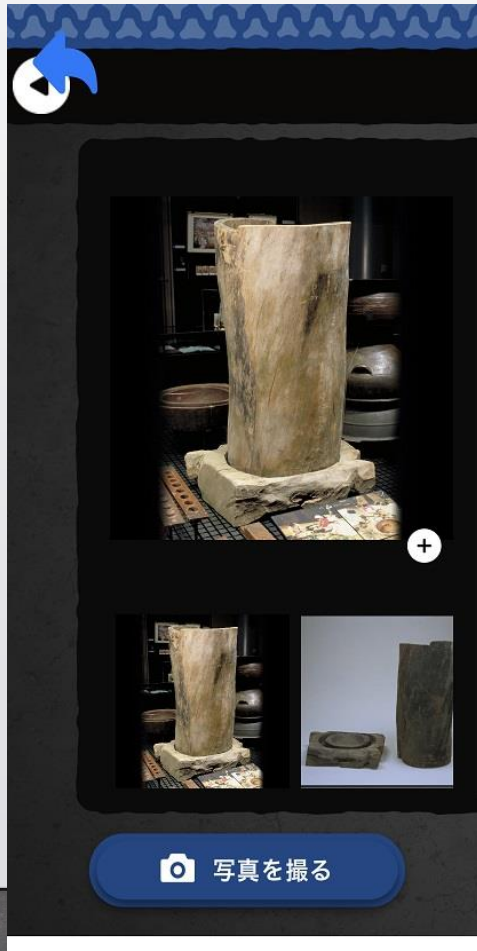**Way for learning in museums**

Quiz about exhibits

This is used to send [?] in rituals.

① signals

② messages

③ letters

Quiz on exhibits

This is placed on a stand for containers in the [?] of the house
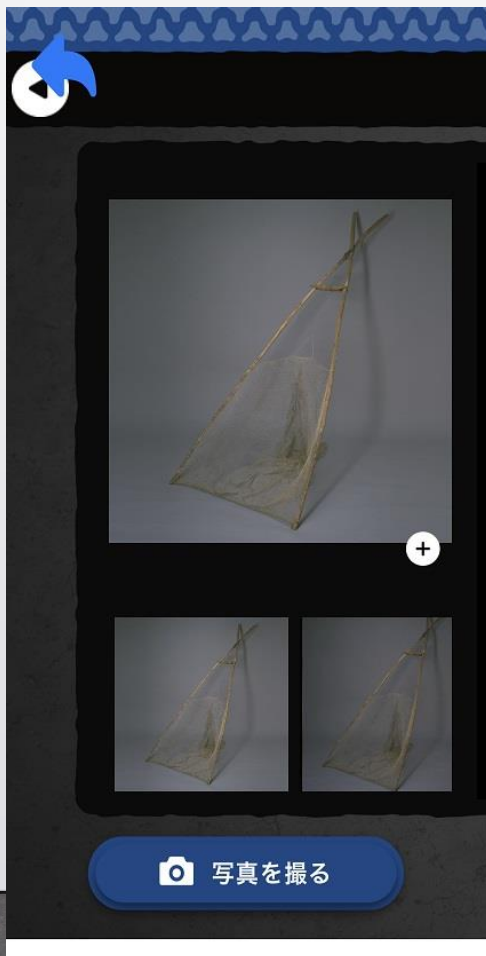
① entrance

② north

③ courtyard

Correct choice

Quiz on exhibits

This is a fishnet that is set up in the [?] to capture the fish that are inside.

① river

Correct choice

② forest

③ sea
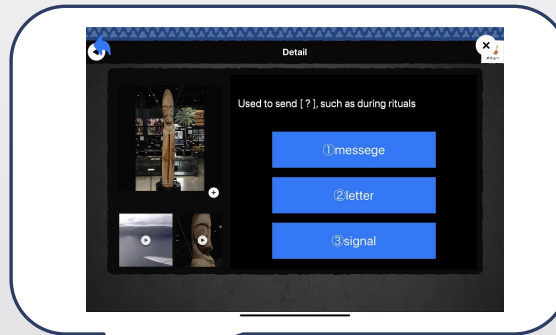
写真を撮る

Let's try the quiz everyone!

This is called "White Heart" because the [?] of the bead is white.

①color
②most
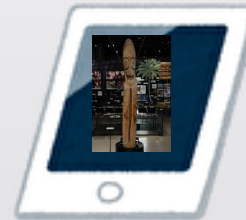③center

Correct choice:
③center

Effects of using a quiz

- Visitors look for information that will give them hints to solve the quiz.

Effects of using a quiz

- Visitors will also actively look for information in the exhibits, descriptions, and electronic guides they find.

Visitors understand the exhibits more deeply

Minpaku's
electronic guide application

- This is an electronic guide application that we have developed before.

- It uses data provided by Minpaku.
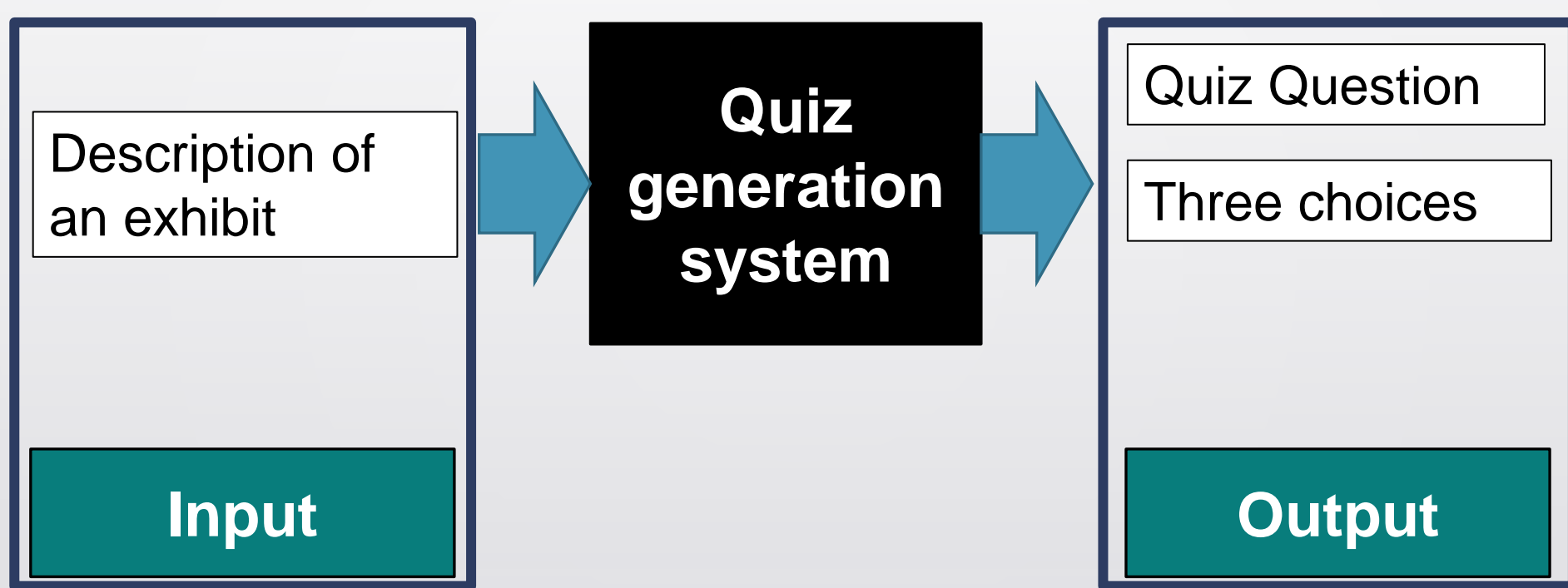
Images of the exhibits are displayed.

Visitors can access detailed information by tapping on the images of the exhibits.

On the screen displaying detailed information, visitors can see the name and description of the exhibit.

Problem definition of Quiz generation

Input		Output
Description of an exhibit	Quiz generation system	Quiz Question Three choices

A concrete example

Splintered wood drum

Description:
Instrument. This is used to send signals in rituals. This is an instrument that is stood upright and beaten with a wooden stick to make a sound.

Quiz generation example

Description of a exhibit
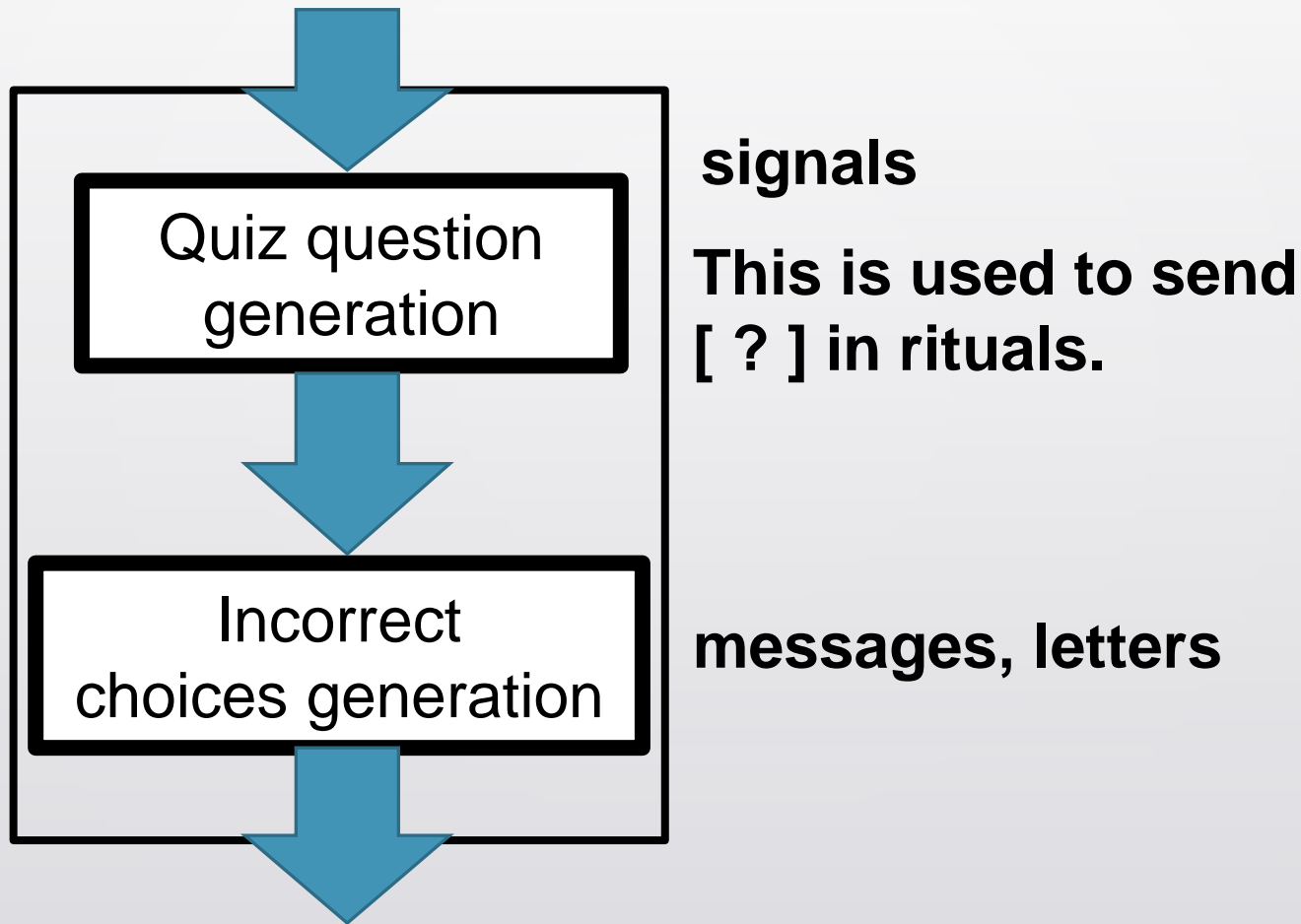**This is used to send signals in rituals.**

Input

Quiz generation system

Quiz Question
This is used to send [?] in rituals.

Three choices
**signals
messages
letters**

Output

Process of quiz generation system

signals

This is used to send [?] in rituals.

Quiz question generation

Incorrect choices generation

messages, letters

①Quiz question generation

A noun in the sentence is selected at random

The part of the selected word becomes blank.

This is used to send signals in rituals.

The word "**signals**" is selected.

generate

This is used to send [?] in rituals.

①Quiz question generation

This is used to send signals in rituals.

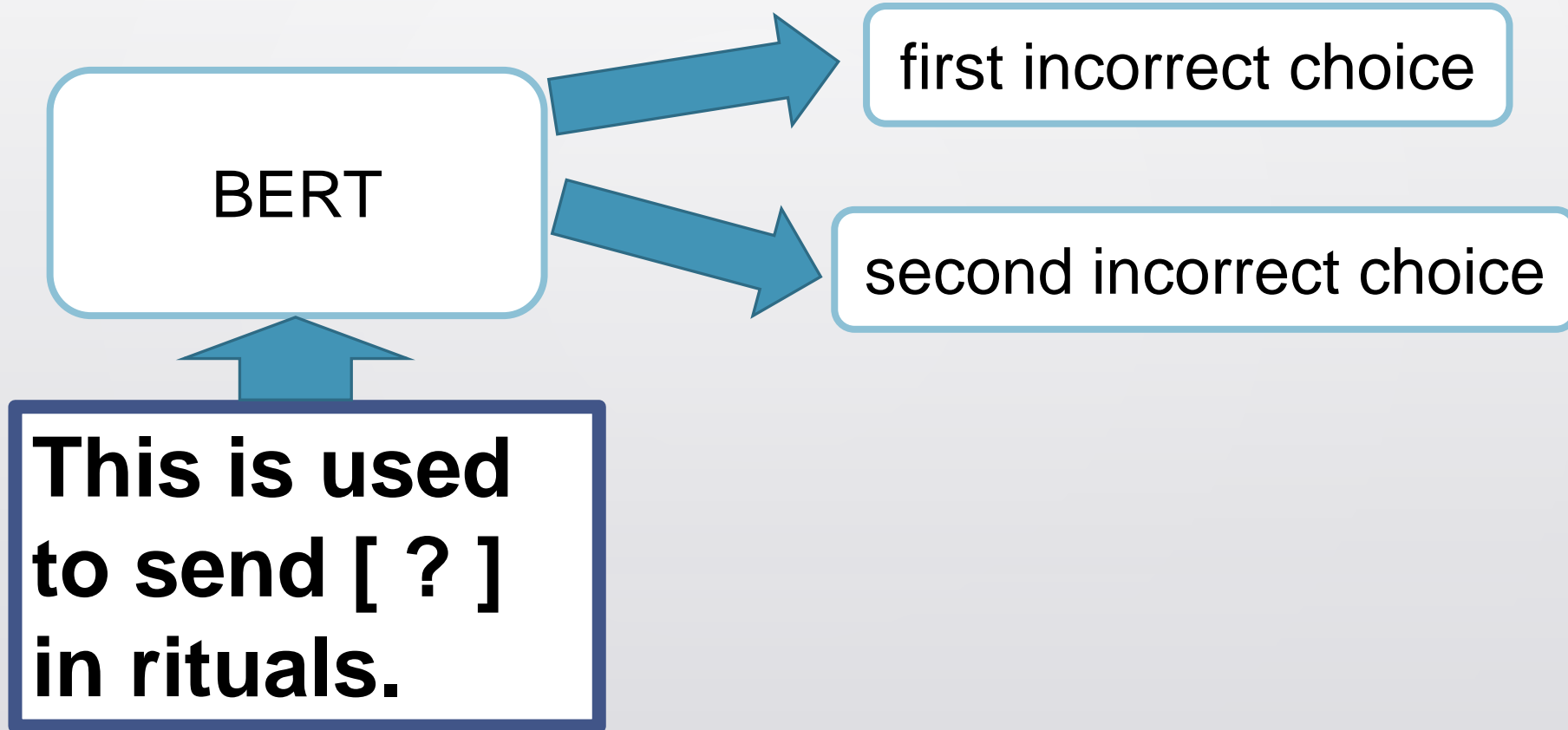The word "**signals**" is selected.

Correct choice →

The selected word is the correct choice.

signals

②Incorrect choices generation

first incorrect choice

BERT

second incorrect choice

This is used to send [?] in rituals.

BERT

- A popular language model
- Used for various tasks.
  - Sentence vectorization
  - Sentiment analysis
  - Question answering
  - And more

Language models

- Normal language models
  - Used to predict the next word in a sentence using previous words
- BERT
  - Predict a word in the middle of a sentence using words from both sides

Example of BERT

The [MASK] of Japan is Tokyo

capital, city, prefecture,…

BERT additional training

- Pretrained BERT model using data from Japanese Wikipedia
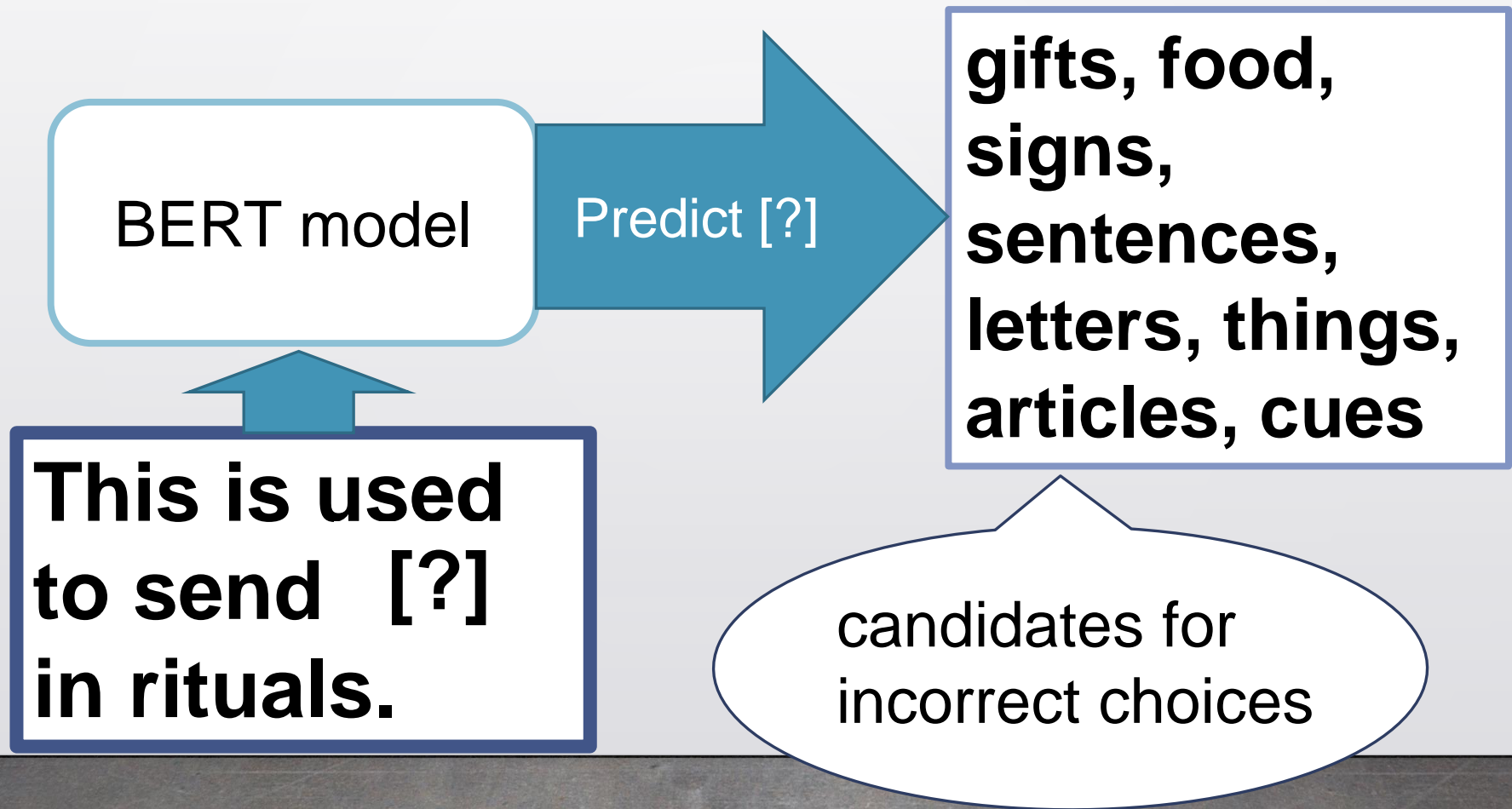- Additional training using the descriptions of the exhibits.

Pre-trained BERT + Additional training → Trained with exhibit descriptions BERT model

②Incorrect choices generation

BERT model

Predict [?]

gifts, food, signs, sentences, letters, things, articles, cues

This is used to send [?] in rituals.

candidates for incorrect choices

②Incorrect choices generation

- If there are hypernyms or hyponyms in the choices, the quiz will be inappropriate.

Candidates:
gifts, food, signs, sentences, letters, things, articles, cues

Correct choice:
signals

Candidates for incorrect choices include hypernyms and hyponyms of the correct choice.

②Incorrect choices generation

Candidates:
gifts, food,

**sentences,
letters, things,
articles**

WordNet's output
(**signals**):
**signal, sign, cue,
communication**

We used **WordNet** to output the hypernyms and hyponyms of the choices and remove the words that match the candidate incorrect choices.

②Incorrect choices generation

Candidates:
gifts, food,

sentences, letters, things, articles

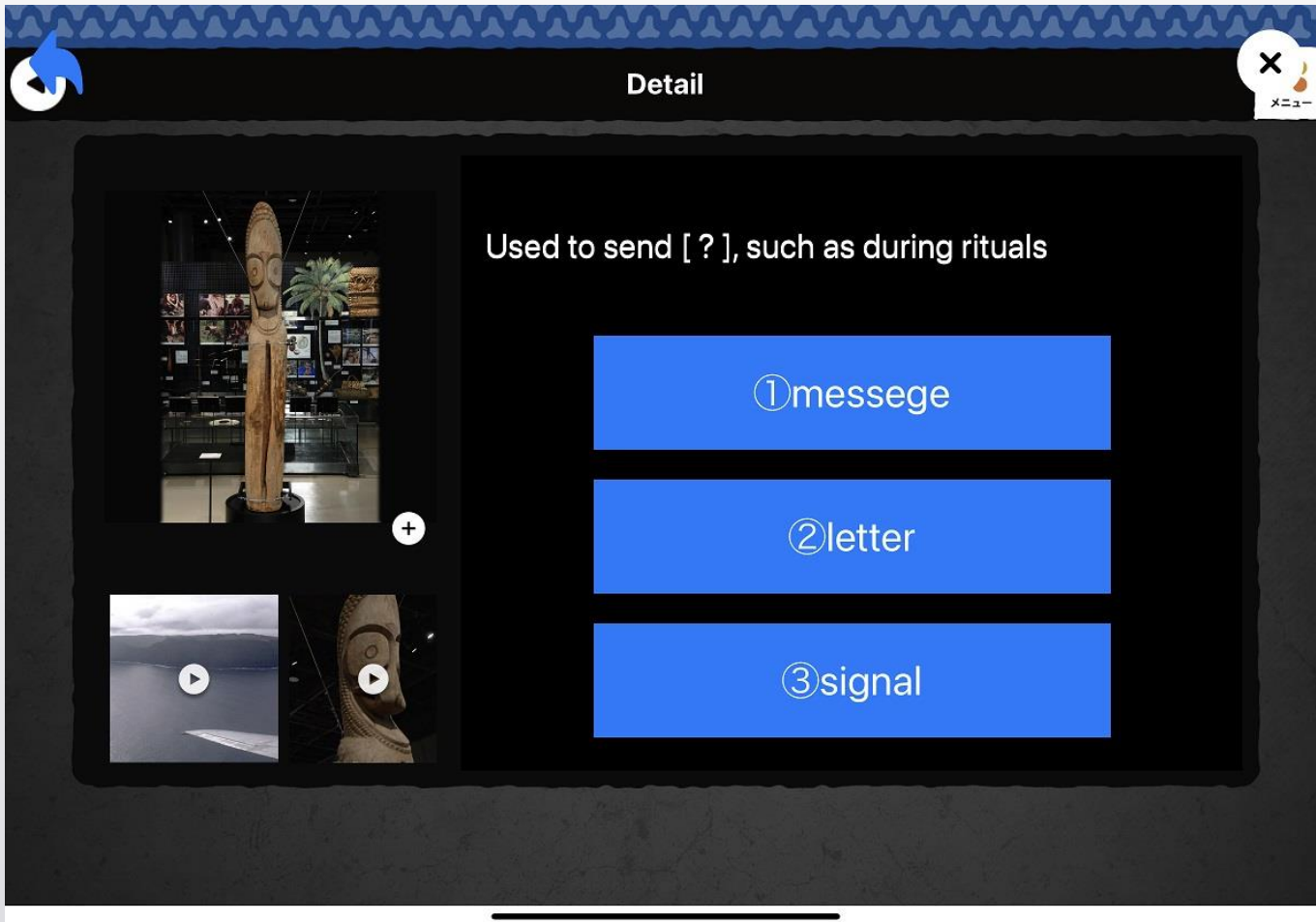Select from a candidate of incorrect choices.

messages, letters

Generated quiz

User Experiment

- Place:
  National Museum of Ethnology, Japan
- Subjects use the Minpaku's electronic guide application.
- This experiment is conducted with two groups of subjects
  - Use the application with quiz system
  - Use the application without quiz system

User Experiment

- We take questionnaires from the subjects after the visit.

- The questionnaire has 13 questions.
- Answers are on a 5-point Likert scale for each question.
  - 1=not at all
  - 5=totally agree

Results and Discussion

I was able to get interested in the exhibits.

- With quiz: **4.75**   Without quiz: 3.57

Could you understand the information about the exhibits?

- With quiz: **4.00**   Without quiz: 2.71

Did you actively look at the exhibits?

- With quiz: **3.86**   Without quiz: 4.50

Results and Discussion

Quizzes are effective to improve learning experiences during museum visits

Conclusion

- The goal of this research is improving learning through museum visits.

- We have developed a system that automatically generates quizzes using the descriptions of the exhibits.

- We showed that the use of quizzes in the visit could improve the learning.