Research Results on System Development of the Research Project of a Self-Study System for Language Learning

Katsuyuki Umezawa — Shonan Institute of Technology, Japan
Manabu Kobayashi — Waseda University, Japan
Michiko Nakano — Waseda University, Japan
Makoto Nakazawa — Junior College of Aizu, Japan
Yutaka Ishii — Chiba University, Japan
Shigeichi Hirasawa — Waseda University, Japan

Table of Contents

1. Introduction

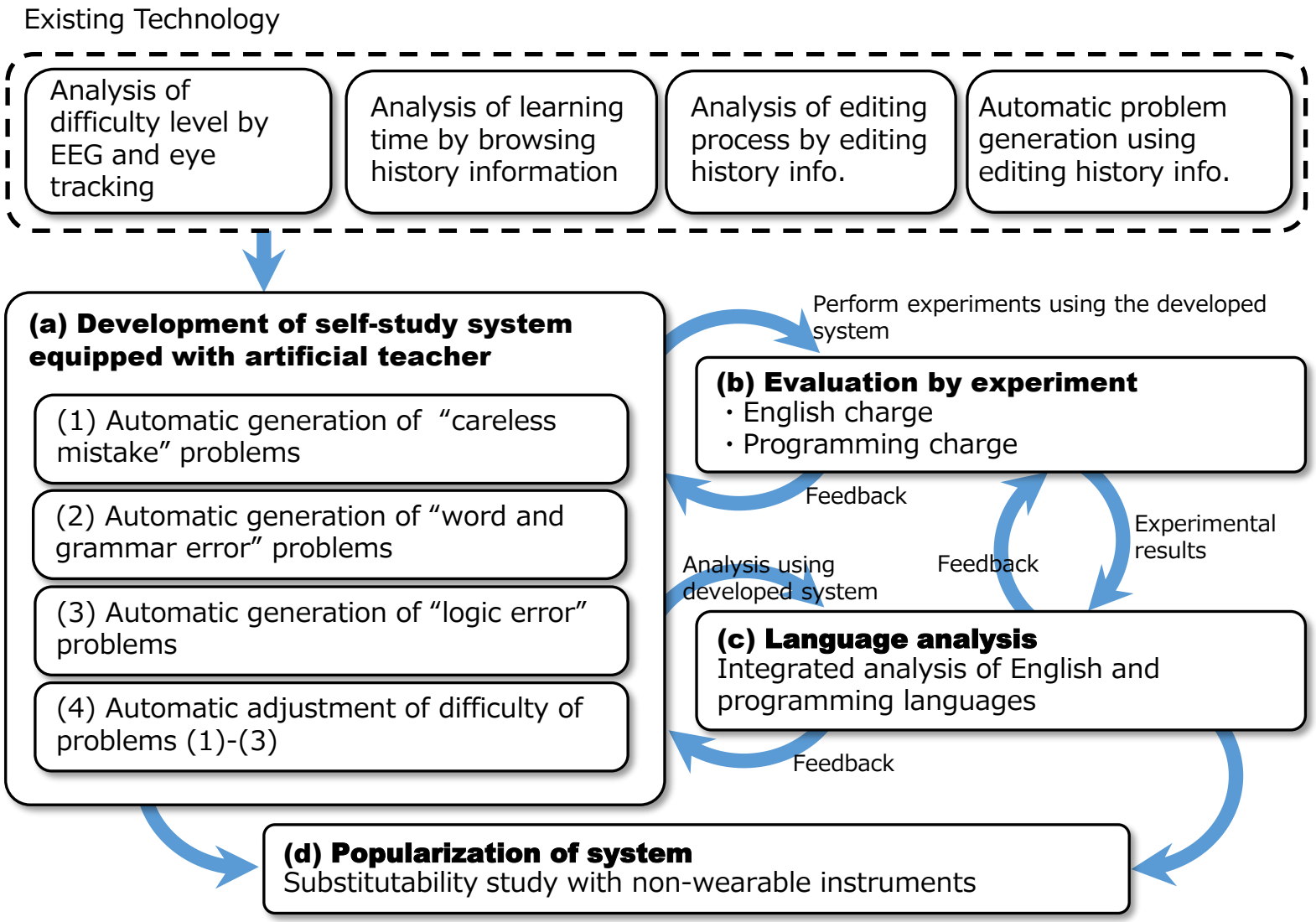
- Develop a self-study system equipped with an artificial teacher who gives advice to students by detecting the learners.
- “Detecting the learners” means that the system understands the learners’ learning conditions.
- We will conduct analysis from different viewpoints of language learning, such as learning English and programming languages.
- In this presentation, we propose a system to efficiently collect brain waves from learners by focusing on only the brain waves among the biological information for “detecting the learners”.

1. Introduction

- Develop a self-study system equipped with an artificial teacher who gives advice to students by detecting the learners.
- “Detecting the learners” means that the system understands the learners’ learning conditions.
- We will conduct analysis from different viewpoints of language learning, such as learning English and programming languages.
- In this presentation, we propose a system to efficiently collect brain waves from learners by focusing on only the brain waves among the biological information for “detecting the learners”.

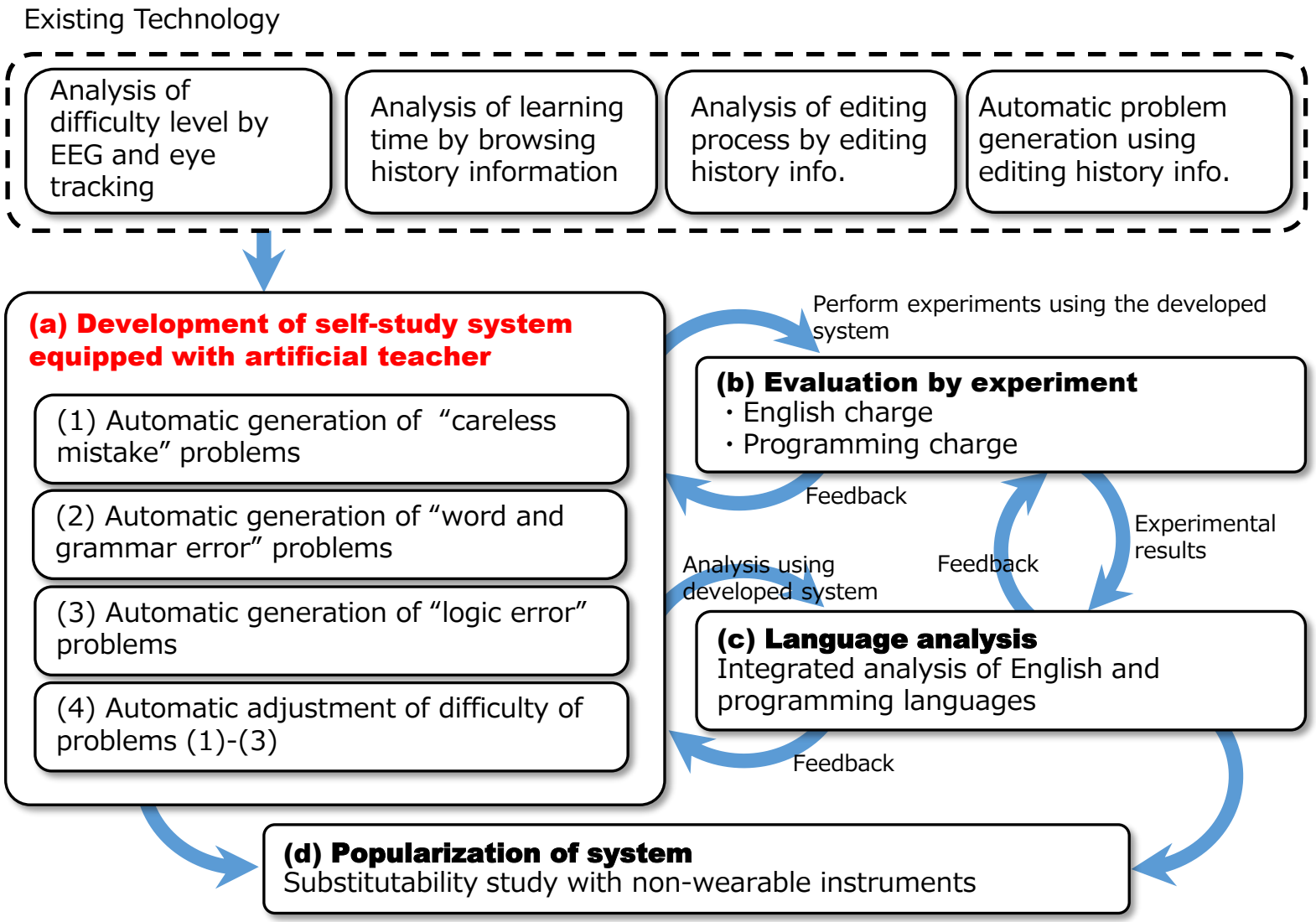
2. Research strategy

2.1 Overview of our project

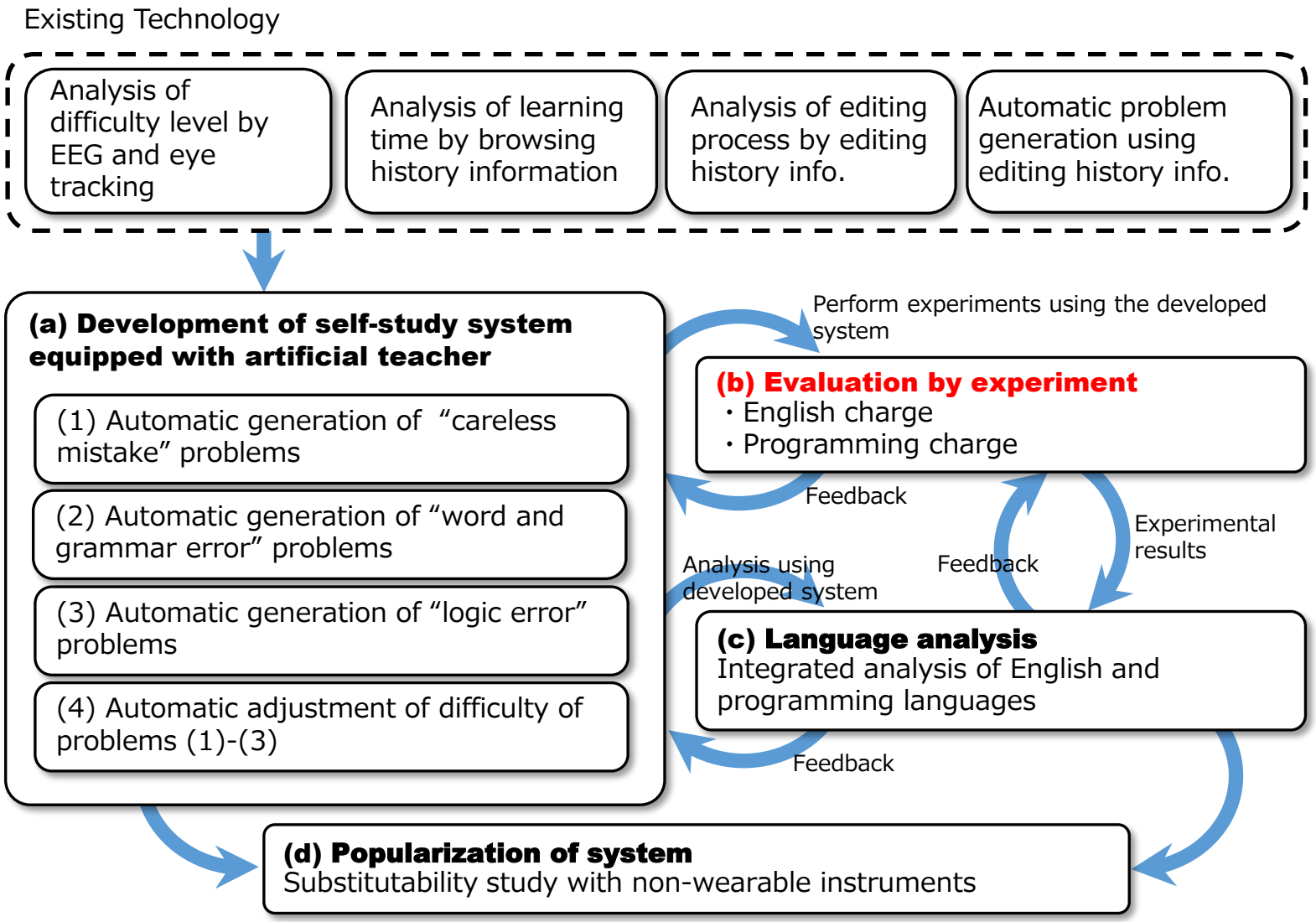


2. Research strategy

2.1 Overview of our project

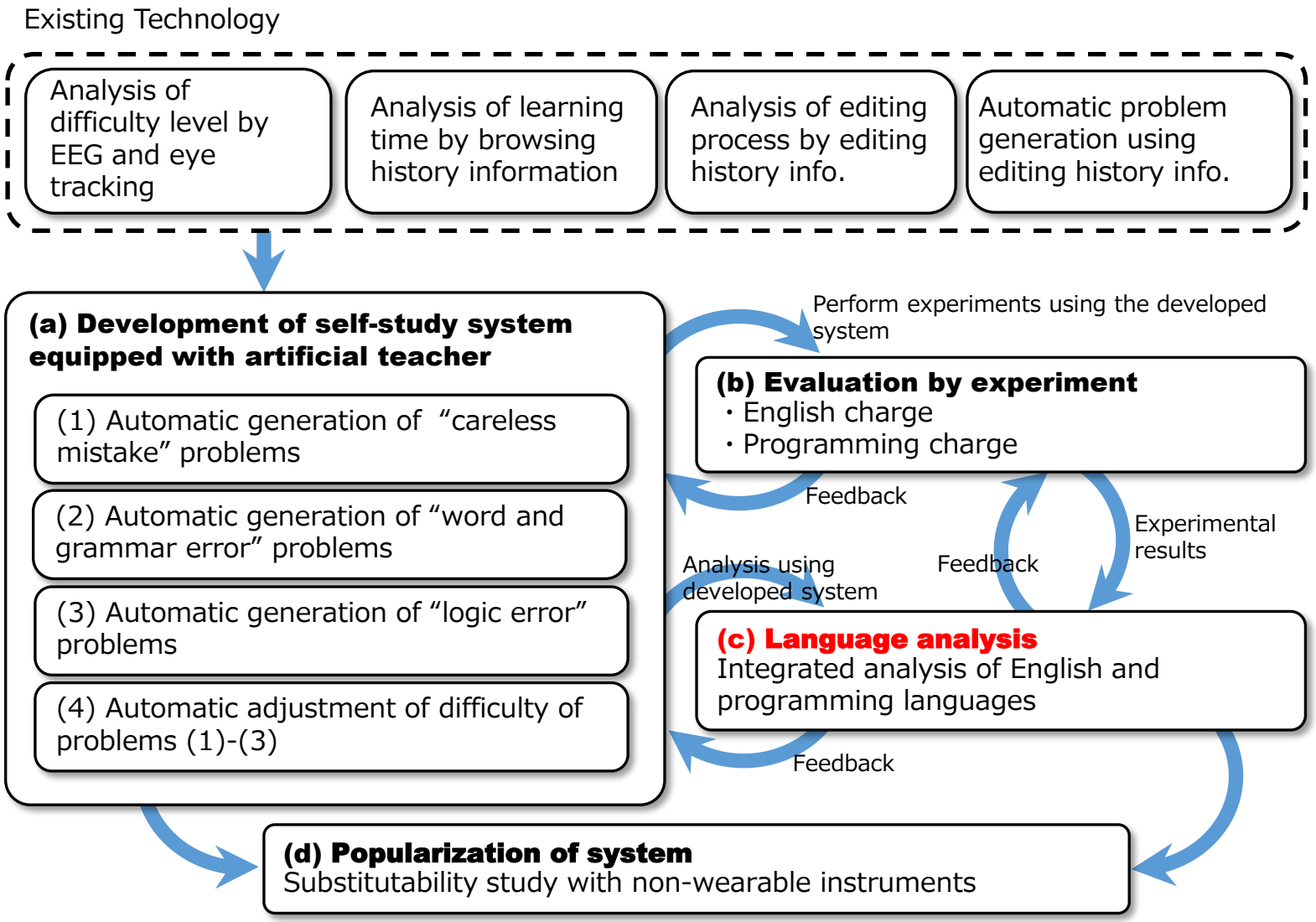


2. Research strategy
2.1 Overview of our project



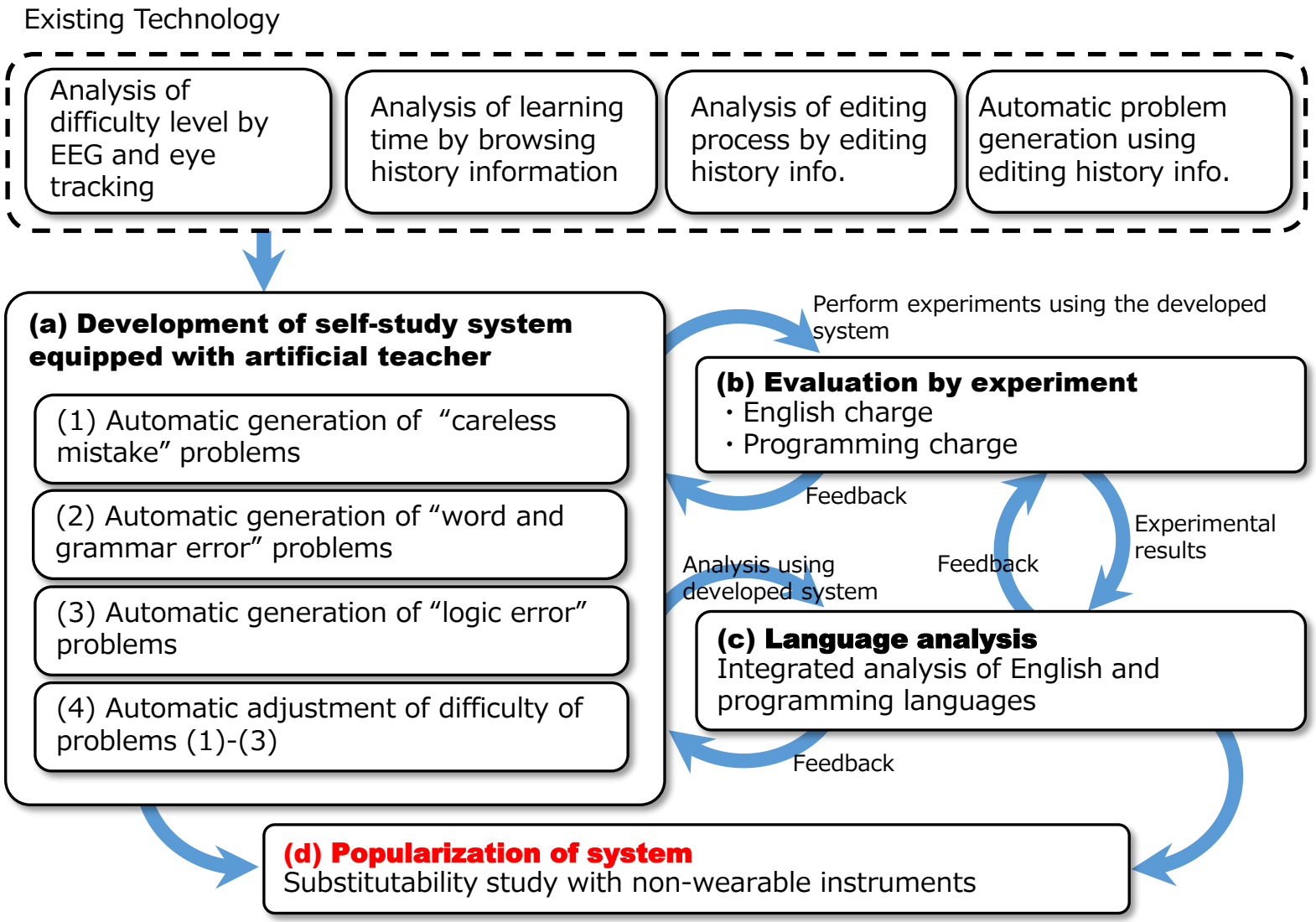
2. Research strategy

2.1 Overview of our project



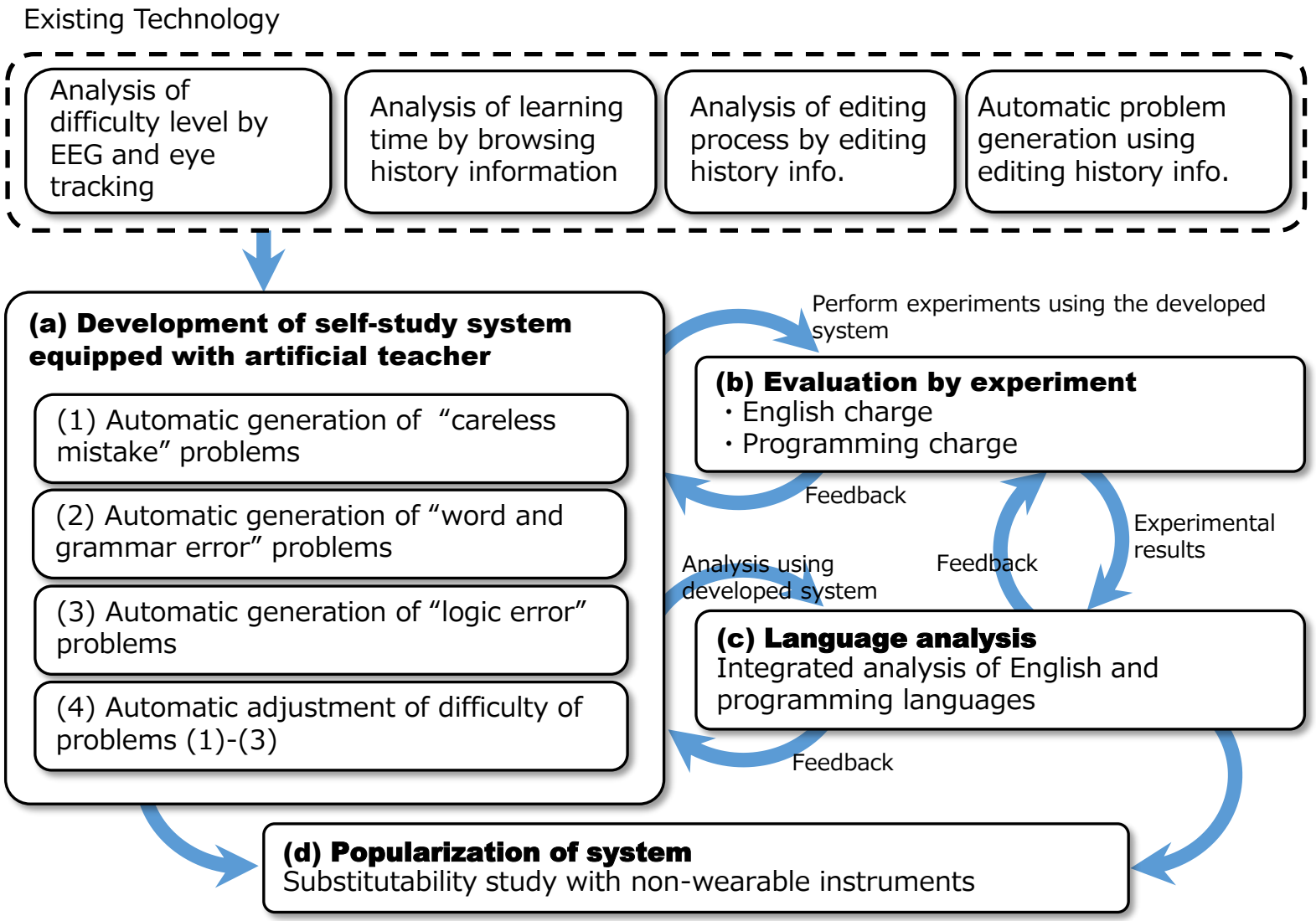
2. Research strategy

2.1 Overview of our project

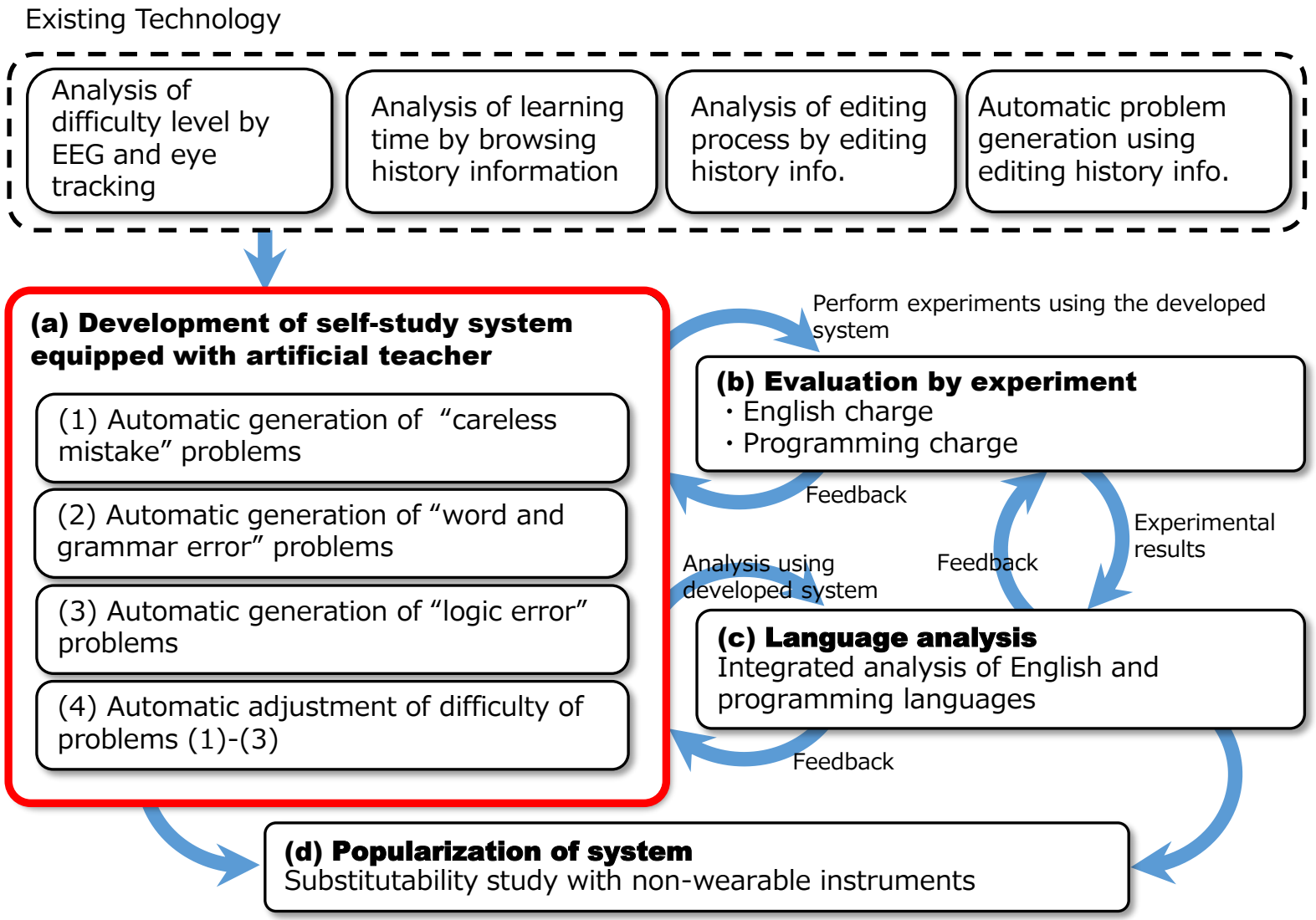


2. Research strategy

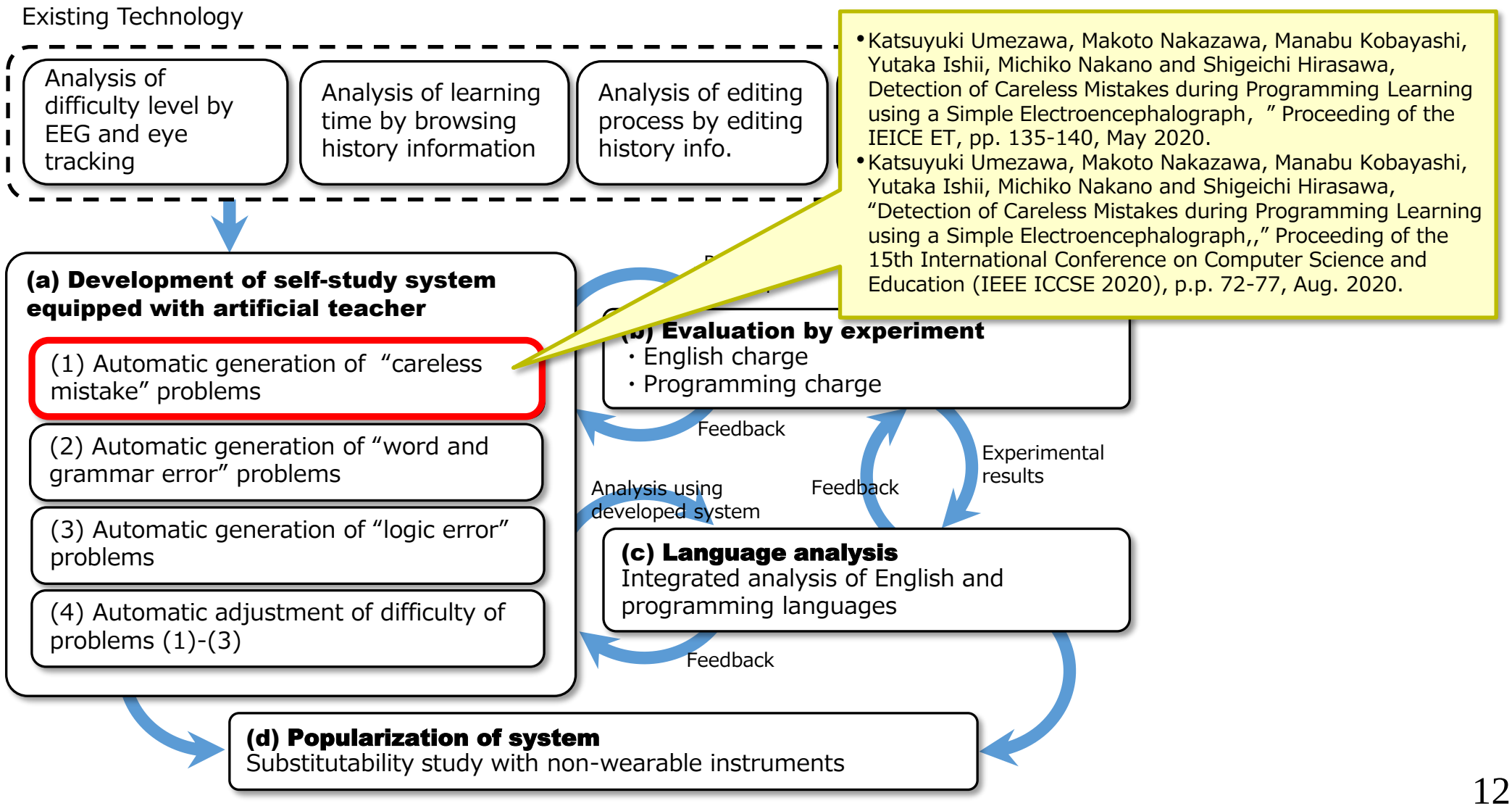
2.1 Overview of our project



2. Research strategy



2. Research strategy
2.1 Overview of our project

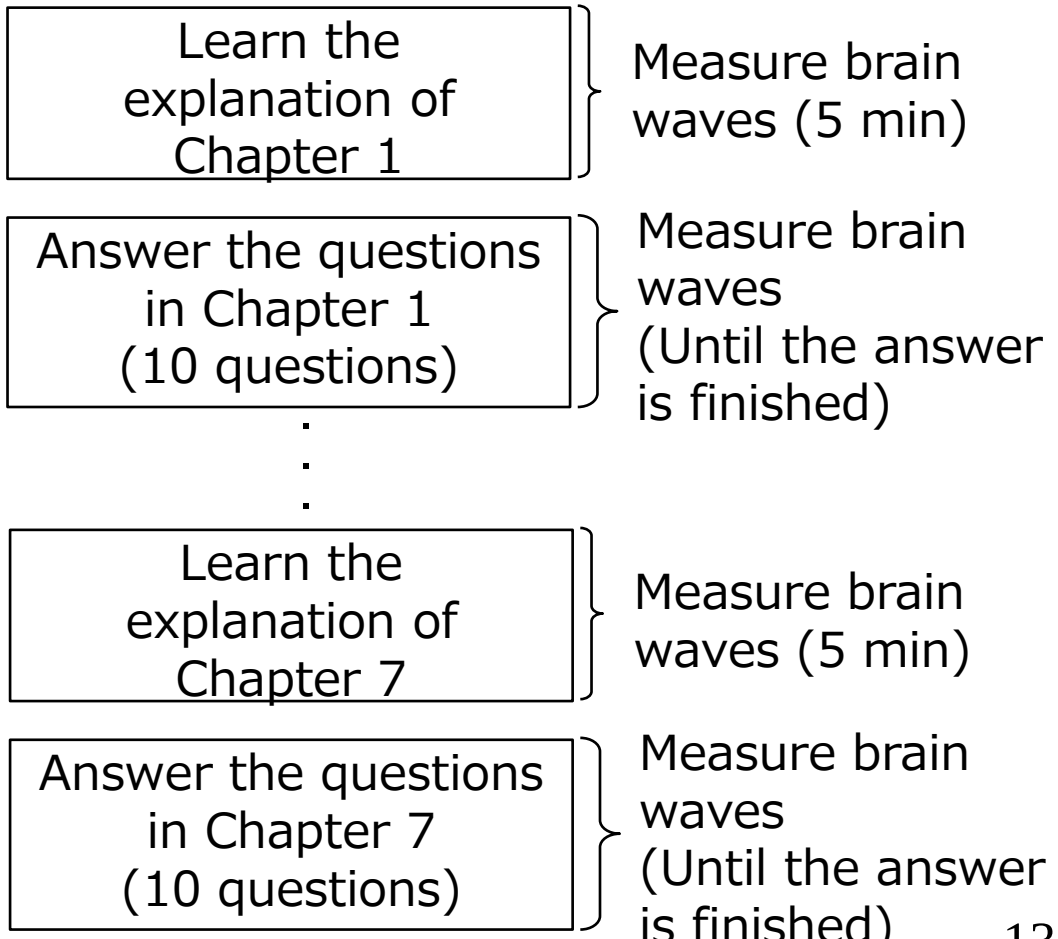


- Katsuyuki Umezawa, Makoto Nakazawa, Manabu Kobayashi, Yutaka Ishii, Michiko Nakano and Shigeichi Hirasawa, Detection of Careless Mistakes during Programming Learning using a Simple Electroencephalograph, " Proceeding of the IEICE ET, pp. 135-140, May 2020.
- Katsuyuki Umezawa, Makoto Nakazawa, Manabu Kobayashi, Yutaka Ishii, Michiko Nakano and Shigeichi Hirasawa, "Detection of Careless Mistakes during Programming Learning using a Simple Electroencephalograph,," Proceeding of the 15th International Conference on Computer Science and Education (IEEE ICCSE 2020), p.p. 72-77, Aug. 2020.

3. Outcome of our Research

3.1 How to judge careless mistakes

- Three fourth-year students from the Shonan Institute of Technology participated in our experiment.
- The learning target of the experiment is the Java language basics.
  - Chapter 1: Variables, Operations
  - Chapter 2: Branch
  - Chapter 3: Repetition
  - Chapter 4: Array
  - Chapter 5: Method
  - Chapter 6: Class 1
  - Chapter 7: Class 2
- The participants learn seven chapters.
- In each chapter, materials explain the contents, and 10 questions are included to measure comprehension.

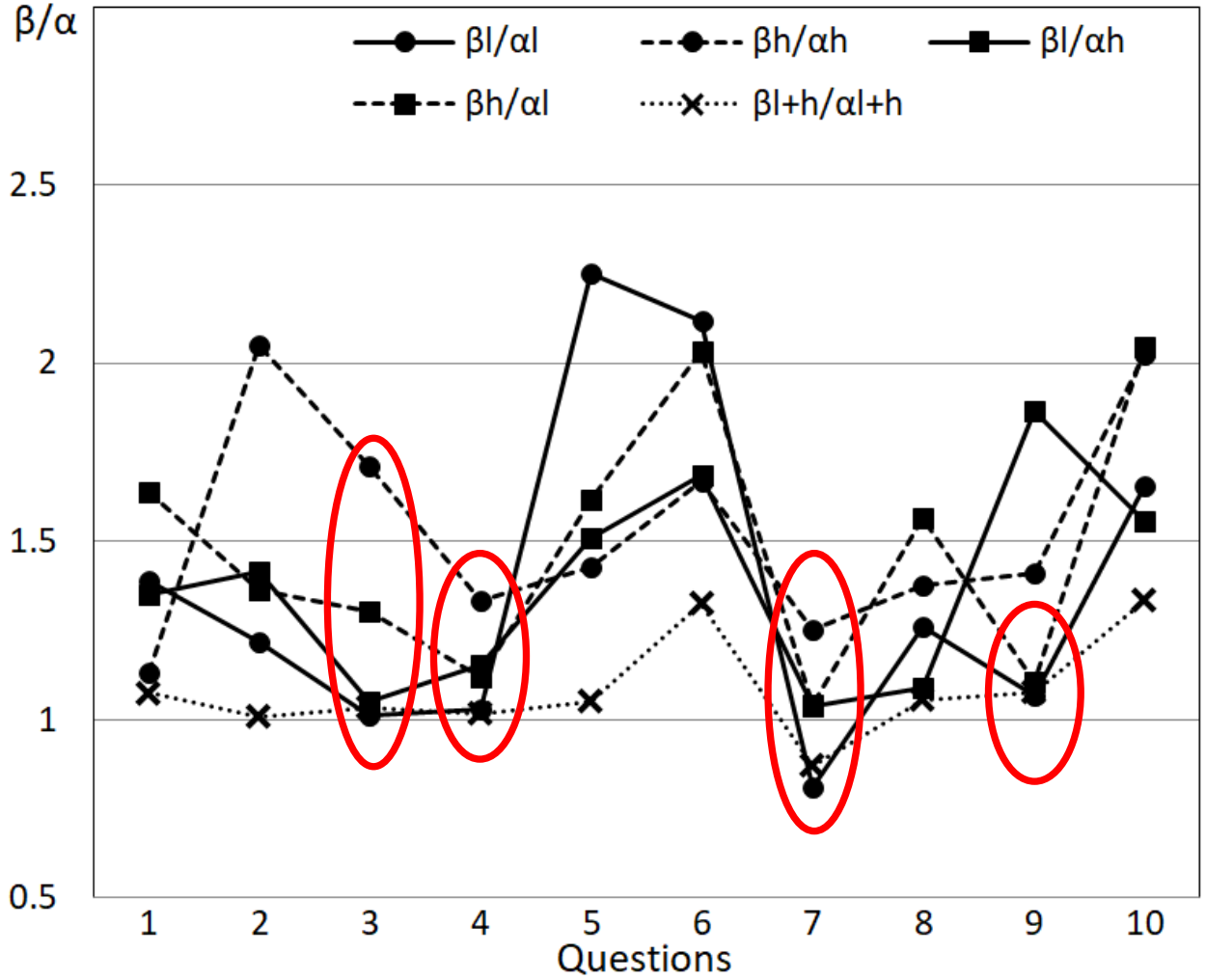


3. Outcome of our Research

3.1 How to judge careless mistakes

An example of experimental results

- The red circle is where *β/α* is likely to drop.
- If the answer is incorrect, the response time is short, and β / α is statistically significantly low, it is considered to be a careless mistake.



Average EEG when answering each question in Chapter 6 of Participant 3

3. Outcome of our Research

3.1 How to judge careless mistakes

				the average value of the EEG while solving the questions from the first question to target question					The average value of the EEG while solving the target question.				
Participants	Chapters	Questions	Time（s）	βl/al	βh/ah	βl/ah	βh/al	βl+h/al+h	βl/al	βh/ah	βl/ah	βh/al	βl+h/al+h
1	3	2	25	0.871	1.904	1.382	1.572	0.908	1.575	1.871	1.097	2.838	1.555
	7	3	29	0.709	0.982	0.778	0.737	0.570	0.734	0.800	1.083	0.561	0.560
2	3	7	39	1.499	1.351	1.385	1.302	0.976	1.146	1.518	1.959	1.093	0.993
	4	8	17	1.038	1.257	1.274	1.002	0.856	1.128	0.946	1.303	0.829	0.880
	5	10	27	1.372	1.240	1.303	1.292	0.950	1.273	1.216	1.380	1.133	0.964
	7	5	38	1.167	1.218	1.216	1.254	0.928	1.380	1.122	1.226	1.800	0.887
	7	7	30	1.180	1.208	1.211	1.264	0.911	1.028	1.649	1.672	1.000	1.120
	7	8	35	1.168	1.243	1.248	1.243	0.928	0.962	1.149	0.956	1.267	0.899
	8	2	28	1.316	1.369	1.259	1.176	1.068	0.860	1.197	1.176	0.841	0.871
3	2	6	40	1.636	1.811	1.375	1.967	1.239	1.199	2.130	1.495	1.834	1.142
	2	7	24	1.583	1.849	1.389	1.951	1.228	1.178	2.198	1.166	1.822	1.202
	2	9	39	1.469	1.761	1.386	1.781	1.172	1.020	**1.290**	1.365	**0.992**	1.017
	3	9	11	1.455	1.673	1.338	1.673	1.151	1.412	1.387	1.096	2.160	1.262
	3	10	34	1.453	1.662	1.329	1.691	1.155	1.172	1.965	1.450	1.638	1.156
	4	3	26	1.283	1.330	1.201	1.638	1.013	1.376	1.488	1.111	1.901	1.158
	4	5	14	1.266	1.477	1.154	1.754	1.112	2.581	2.232	1.620	2.445	1.488
	4	9	43	1.370	1.461	1.121	1.759	1.101	**0.899**	1.275	1.057	**1.165**	0.926
	5	7	40	1.349	1.410	1.337	1.458	1.071	**0.904**	1.536	1.110	1.229	1.025
	5	10	26	1.346	1.454	1.356	1.507	1.098	2.268	1.448	1.291	2.218	1.342
	6	3	43	1.283	1.701	1.392	1.468	1.033	1.010	1.712	1.053	1.305	1.034
	6	5	24	1.144	1.601	1.241	1.330	1.029	2.252	1.430	1.511	1.616	1.052
	6	7	38	1.488	1.602	1.376	1.532	1.105	**0.812**	1.251	1.040	**1.044**	**0.871**
	6	9	17	1.377	1.525	1.289	1.488	1.072	1.067	1.413	1.864	1.105	1.076
	7	3	30	1.197	1.449	1.191	1.541	1.093	1.279	1.658	1.216	1.540	1.118
	7	4	33	1.222	1.514	1.199	1.540	1.101	1.731	1.551	1.381	2.377	1.223
	7	5	36	1.356	1.524	1.247	1.760	1.133	1.244	1.323	1.167	1.286	0.994
	7	9	40	1.289	1.643	1.317	1.747	1.169	2.926	1.729	1.605	2.426	1.569
	8	3	18	1.648	1.810	1.363	2.202	1.216	2.918	**1.018**	1.116	1.715	0.996
	8	9	30	1.968	1.727	1.408	2.603	1.266	**1.106**	1.714	1.134	**1.560**	1.226

3. Outcome of our Research

3.1 How to judge carel

The first participant had some wrong answers. It is assumed that he was good at Java programming.

Participants	Chapters	Questions	Time（s）	the average … while solving the questions … first question to target question					The average value of the EEG while solving the target question.				
				βl/al	βh/ah	βl/ah	βh/al	βl+h/al+h	βl/al	βh/ah	βl/ah	βh/al	βl+h/al+h
1	3	2	25	0.871	1.904	1.382	1.572	0.908	1.575	1.871	1.097	2.838	1.555
	7	3	29	0.709	0.982	0.778	0.737	0.570	0.734	0.800	1.083	0.561	0.560
2	3	7	39	1.499	1.351	1.385	1.302	0.976	1.146	1.518	1.959	1.093	0.993
	4	8	17	1.038	1.257	1.274	1.002	0.856	1.128	0.946	1.303	0.829	0.880
	5	10	27	1.372	1.240	1.303	1.292	0.950	1.273	1.216	1.380	1.133	0.964
	7	5	38	1.167	1.218	1.216	1.254	0.928	1.380	1.122	1.226	1.800	0.887
	7	7	30	1.180	1.208	1.211	1.264	0.911	1.028	1.649	1.672	1.000	1.120
	7	8	35	1.168	1.243	1.248	1.243	0.928	0.962	1.149	0.956	1.267	0.899
	8	2	28	1.316	1.369	1.259	1.176	1.068	0.860	1.197	1.176	0.841	0.871
3	2	6	40	1.636	1.811	1.375	1.967	1.[illegible]	1.199	2.130	1.495	1.834	1.142
	2	7	24	1.583	1.849	1.389	1.951	1.228	1.178	2.198	1.166	1.822	1.202
	2	9	39	1.469	1.761	1.386	[illegible]	1.172	1.020	1.290	1.365	0.992	1.017
	3	9	11	1.455	1.673	[illegible]	[illegible]	1.151	1.412	1.387	1.096	2.160	1.262
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.172	1.965	1.450	1.638	1.156
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.376	1.488	1.111	1.901	1.158
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.581	2.232	1.620	2.445	1.488
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.899	1.275	1.057	1.165	0.926
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.904	1.536	1.110	1.229	1.025
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.268	1.448	1.291	2.218	1.342
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.010	1.712	1.053	1.305	1.034
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.252	1.430	1.511	1.616	1.052
	6	7	38	1.488	1.602	1.376	1.532	1.105	0.812	1.251	1.040	1.044	0.871
	6	9	17	1.377	1.525	1.289	1.488	1.072	1.067	1.413	1.864	1.105	1.076
	7	3	30	1.197	1.449	1.191	1.541	1.093	1.279	1.658	1.216	1.540	1.118
	7	4	33	1.222	1.514	1.199	1.540	1.101	1.731	1.551	1.381	2.377	1.223
	7	5	36	1.356	1.524	1.247	1.760	1.133	1.244	1.323	1.167	1.286	0.994
	7	9	40	1.289	1.643	1.317	1.747	1.169	2.926	1.729	1.605	2.426	1.569
	8	3	18	1.648	1.810	1.363	2.202	1.216	2.918	1.018	1.116	1.715	0.996
	8	9	30	1.968	1.727	1.408	2.603	1.266	1.106	1.714	1.134	1.560	1.226

The second participant scored a slightly higher number of wrong answers, but we estimated none as careless mistakes. After careful consideration, it is assumed that he erred.

3. O
3.1 H

The third participant had many wrong answers. The following questions can be estimated as careless mistakes:
question 9 in Chapter 2,
question 9 in Chapter 4,
question 7 in Chapter 5,
question 7 in Chapter 6, and
questions 3, and 9 in Chapter 8.
We found that the third participant was more inclined to make careless mistakes at the end of each chapter.

Participants	Cha			olving the questions get question					The average value of the EEG while solving the target question.				
							βh/al	βl+h/al+h	βl/al	βh/ah	βl/ah	βh/al	βl+h/al+h
1							1.572	0.908	1.575	1.871	1.097	2.838	1.555
							.737	0.570	0.734	0.800	1.083	0.561	0.560
2							02	0.976	1.146	1.518	1.959	1.093	0.993
								0.856	1.128	0.946	1.303	0.829	0.880
								0.950	1.273	1.216	1.380	1.133	0.964
								0.928	1.380	1.122	1.226	1.800	0.887
							1.264	911	1.028	1.649	1.672	1.000	1.120
							1.243	8	0.962	1.149	0.956	1.267	0.899
							1.176	1.068	0.860	1.197	1.176	0.841	0.871
3	2	6	40	1.636	1.811	1.375	1.967	1.239	1.199	2.130	1.495	1.834	1.142
	2	7	24	1.583	1.849	1.389	1.951	1.228	1.178	2.198	1.166	1.822	1.202
	2	9	39	1.469	1.761	1.386	1.781	1.172	1.020	**1.290**	1.365	**0.992**	1.017
	3	9	11	1.455	1.673	1.338	1.673	1.151	1.412	1.387	1.096	2.160	1.262
	3	10	34	1.453	1.662	1.329	1.691	1.155	1.172	1.965	1.450	1.638	1.156
	4	3	26	1.283	1.330	1.201	1.638	1.013	1.376	1.488	1.111	1.901	1.158
	4	5	14	1.266	1.477	1.154	1.754	1.112	2.581	2.232	1.620	2.445	1.488
	4	9	43	1.370	1.461	1.121	1.759	1.101	**0.899**	1.275	1.057	**1.165**	0.926
	5	7	40	1.349	1.410	1.337	1.458	1.071	**0.904**	1.536	1.110	1.229	1.025
	5	10	26	1.346	1.454	1.356	1.507	1.098	2.268	1.448	1.291	2.218	1.342
	6	3	43	1.283	1.701	1.392	1.468	1.033	1.010	1.712	1.053	1.305	1.034
	6	5	24	1.144	1.601	1.241	1.330	1.029	2.252	1.430	1.511	1.616	1.052
	6	7	38	1.488	1.602	1.376	1.532	1.105	**0.812**	1.251	1.040	**1.044**	**0.871**
	6	9	17	1.377	1.525	1.289	1.488	1.072	1.067	1.413	1.864	1.105	1.076
	7	3	30	1.197	1.449	1.191	1.541	1.093	1.279	1.658	1.216	1.540	1.118
	7	4	33	1.222	1.514	1.199	1.540	1.101	1.731	1.551	1.381	2.377	1.223
	7	5	36	1.356	1.524	1.247	1.760	1.133	1.244	1.323	1.167	1.286	0.994
	7	9	40	1.289	1.643	1.317	1.747	1.169	2.926	1.729	1.605	2.426	1.569
	8	3	18	1.648	1.810	1.363	2.202	1.216	2.918	**1.018**	1.116	1.715	0.996
	8	9	30	1.968	1.727	1.408	2.603	1.266	**1.106**	1.714	1.134	**1.560**	1.226

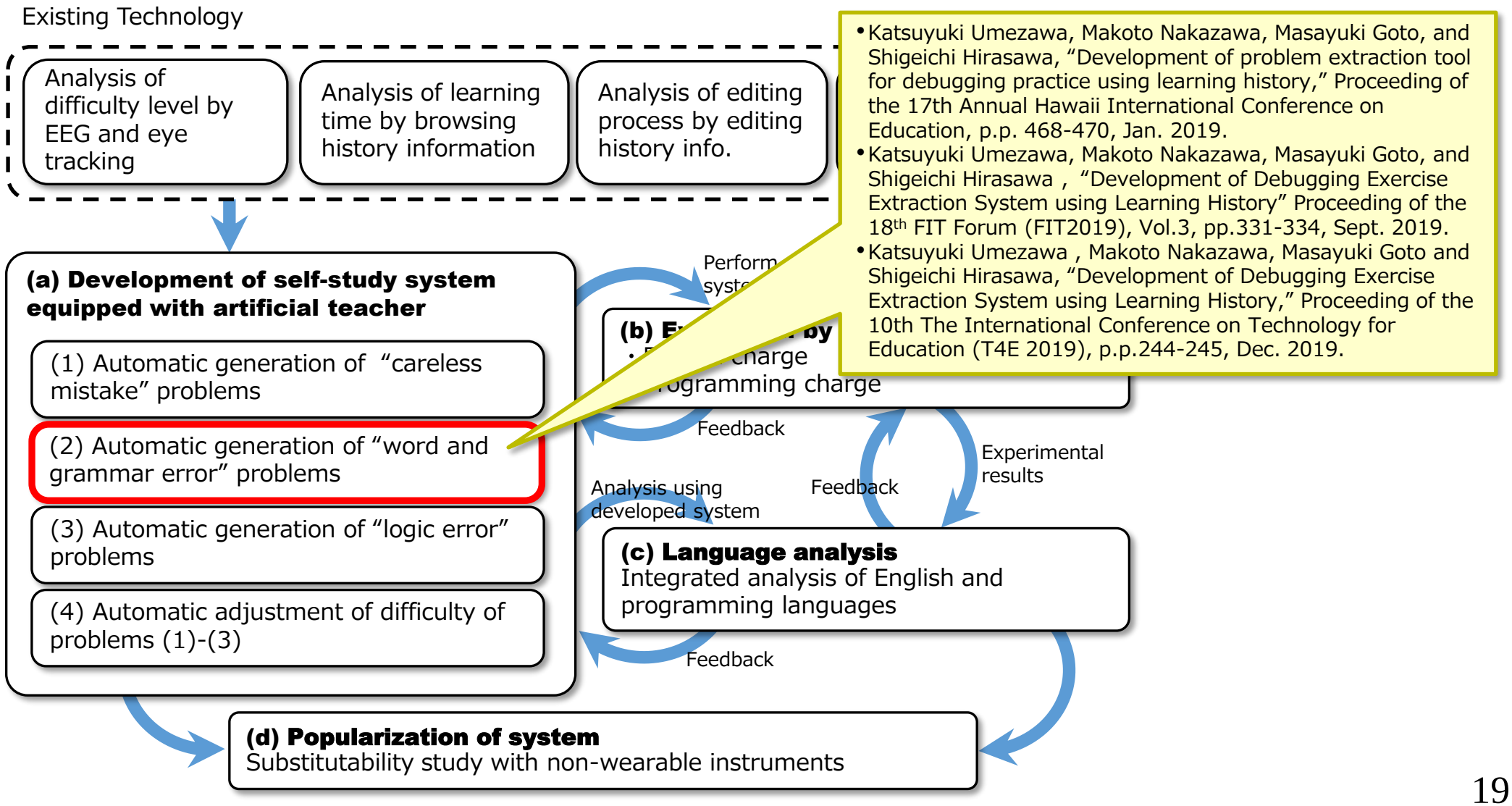
3. Outcome of our Research

3.1 How to judge careless mistakes

Conclusion

- By focusing on the relationship between the response time of the task and the brain waves, we were able to detect careless mistakes when attention was lost.
- Based on this result, we think that it is possible to improve programming skills by intensively training problems that are prone to careless mistakes.

2. Research strategy
2.1 Overview of our project



- Katsuyuki Umezawa, Makoto Nakazawa, Masayuki Goto, and Shigeichi Hirasawa, "Development of problem extraction tool for debugging practice using learning history," Proceeding of the 17th Annual Hawaii International Conference on Education, p.p. 468-470, Jan. 2019.
- Katsuyuki Umezawa, Makoto Nakazawa, Masayuki Goto, and Shigeichi Hirasawa , "Development of Debugging Exercise Extraction System using Learning History" Proceeding of the 18th FIT Forum (FIT2019), Vol.3, pp.331-334, Sept. 2019.
- Katsuyuki Umezawa , Makoto Nakazawa, Masayuki Goto and Shigeichi Hirasawa, "Development of Debugging Exercise Extraction System using Learning History," Proceeding of the 10th The International Conference on Technology for Education (T4E 2019), p.p.244-245, Dec. 2019.

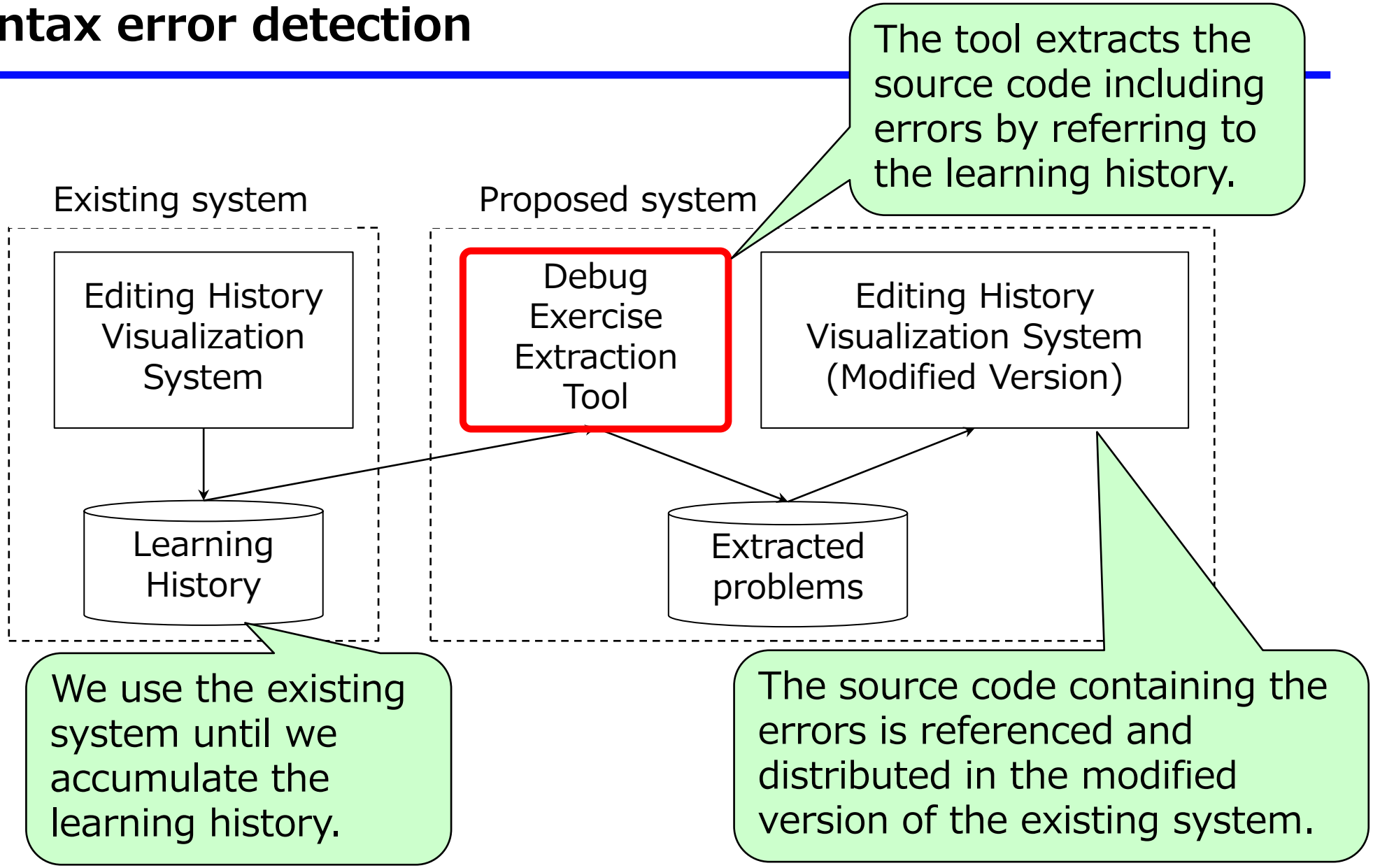
3. Outcome of our Research

3.2 Syntax error detection

- A large number of learning logs were accumulated when approximately 90 students of the Shonan Institute of Technology took a 16-week programming class.
- These learning logs contain all the source code that was adjusted at the end of the program.
- Based on this information, a debug practice question extraction system that extracts source code containing grammatical errors and automatically generates questions for debug practice is developed.

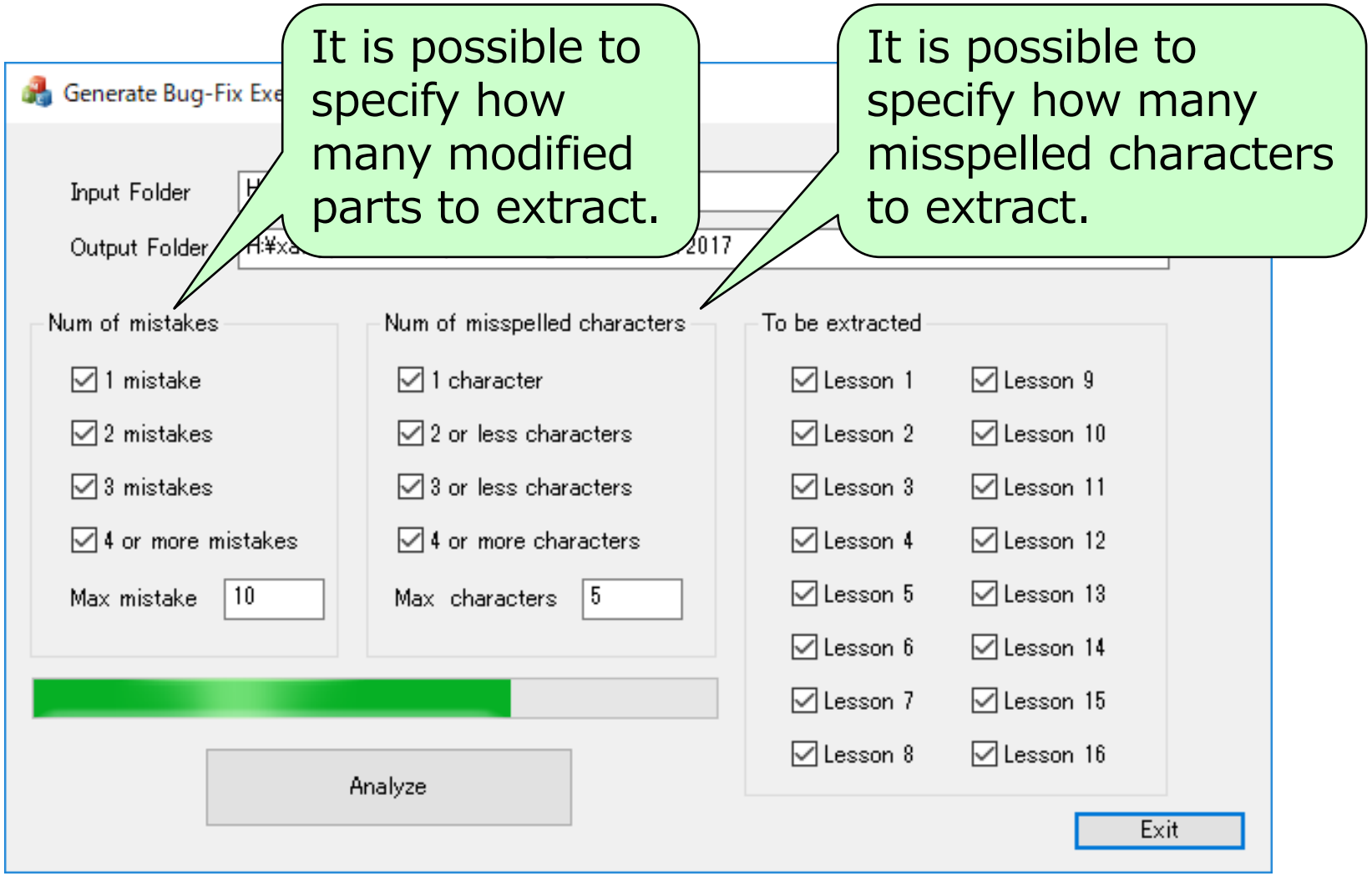
3. Outcome of our Research

3.2 Syntax error detection



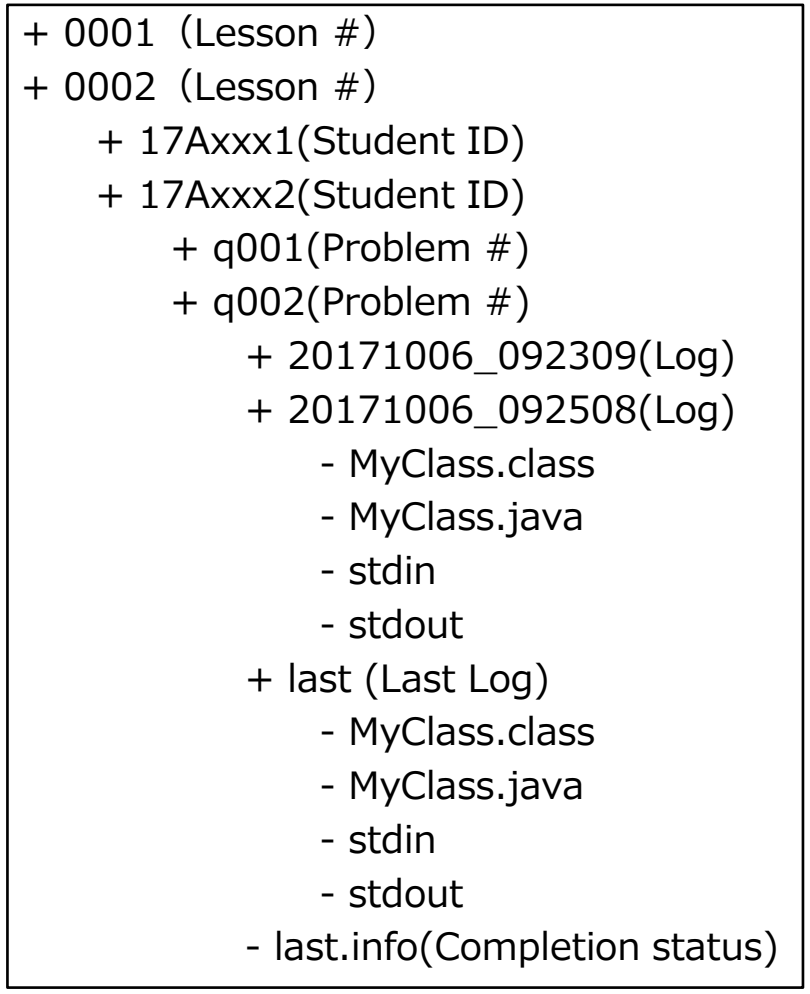
3. Outcome of our Research

3.2 Syntax error detection



3. Outcome of our Research

3.2 Syntax error detection



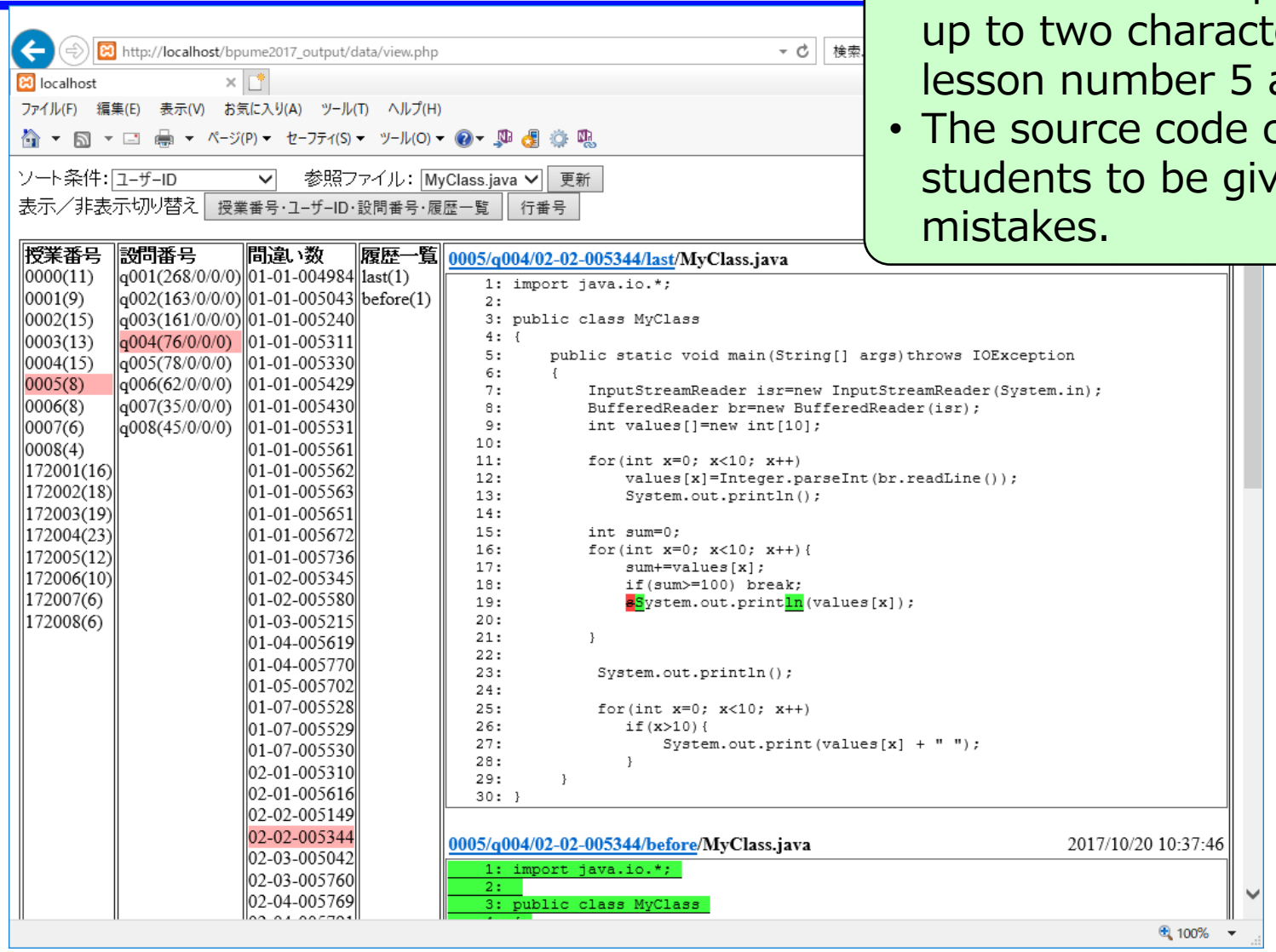
Folder structure of the editing history visualization system

1) Repeat the following for the full history of the left folder.
2) Check to see if "End" is written in the Last.info file.
3) For folders other than the last folder, check to see if "error" is written in the stdout file.
4) Calculate the difference between the MyClass.java in above folder and the MyClass.java in last folder.
5) At that time, the number of differences and how many characters are included in a difference is counted.
6) Copy the MyClass.java to the right folder configuration of the previous page by the above count.

3. Outcome of our Research

3.2 Syntax error detection

- In this figure, the source code including the error of two places and the error of up to two characters of the question 4 of lesson number 5 are shown.
- The source code can be distributed to students to be given a problem to fix mistakes.



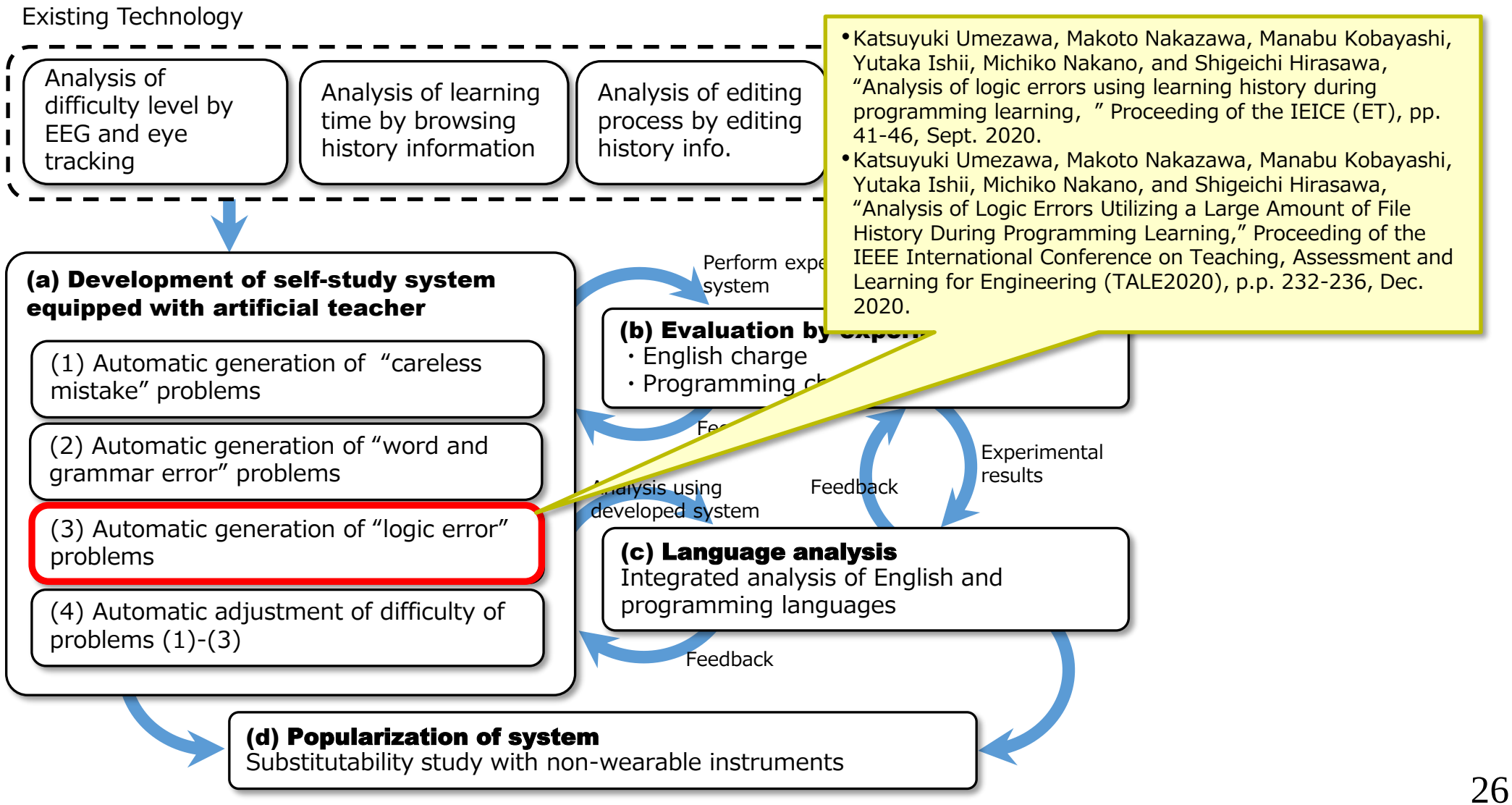
3. Outcome of our Research

3.2 Syntax error detection

Conclusion

- We developed a debugging exercise extraction system to automatically generate problems for debugging practice from learning log.

2. Research strategy
2.1 Overview of our project



- Katsuyuki Umezawa, Makoto Nakazawa, Manabu Kobayashi, Yutaka Ishii, Michiko Nakano, and Shigeichi Hirasawa, "Analysis of logic errors using learning history during programming learning, " Proceeding of the IEICE (ET), pp. 41-46, Sept. 2020.
- Katsuyuki Umezawa, Makoto Nakazawa, Manabu Kobayashi, Yutaka Ishii, Michiko Nakano, and Shigeichi Hirasawa, "Analysis of Logic Errors Utilizing a Large Amount of File History During Programming Learning," Proceeding of the IEEE International Conference on Teaching, Assessment and Learning for Engineering (TALE2020), p.p. 232-236, Dec. 2020.

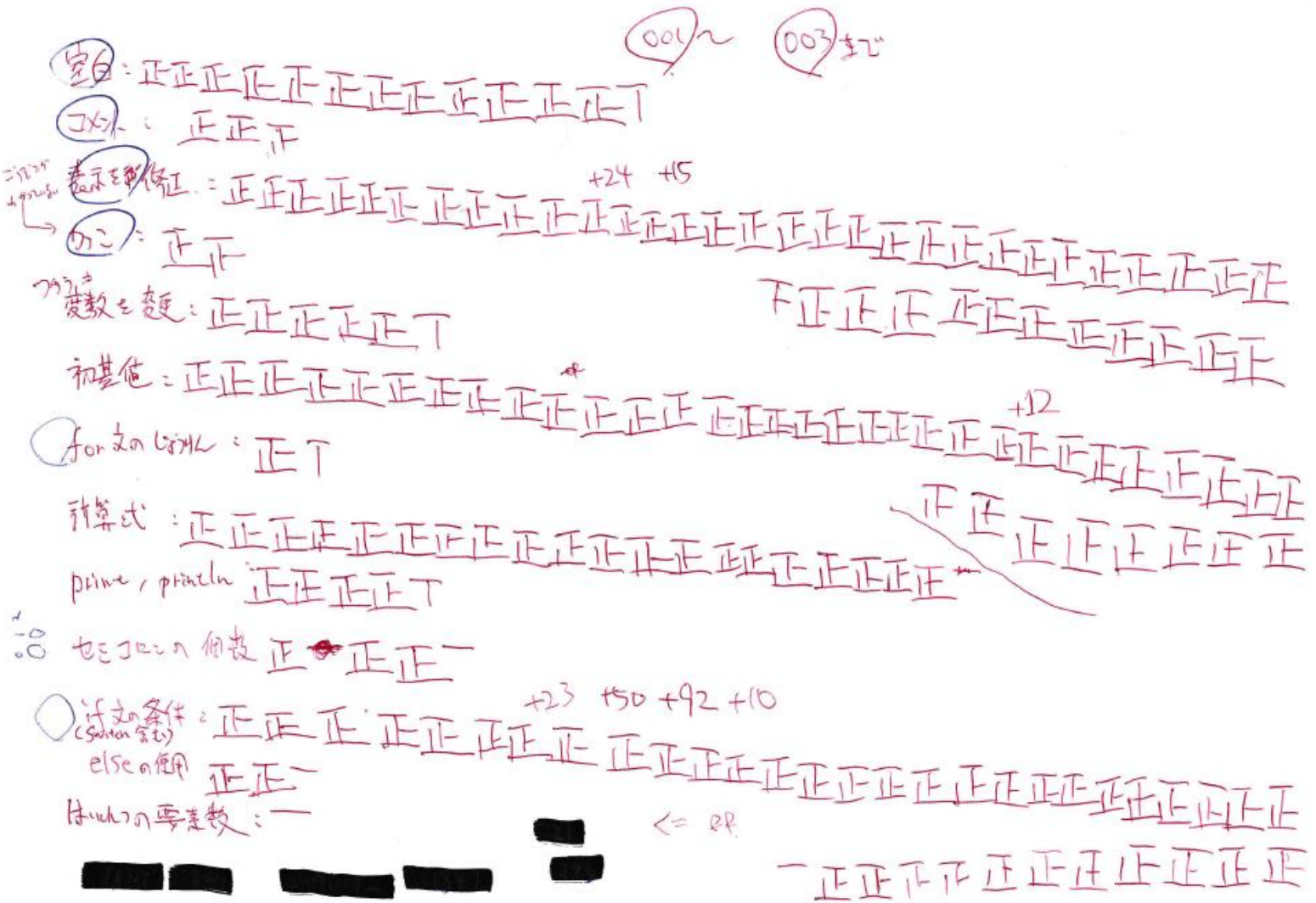
3. Outcome of our Research

3.3 Logical error detection

- The algorithm shown in previous syntax error detection contains a step to confirm whether the “error” is explicitly described in the learning history.
- This checking allows identification of the program source file causing the syntax error.
- However, in this case we want to analyze logic errors.
- The above algorithm targets syntax errors, and hence handles the set of program source files in which “errors” are explicitly described in the learning history.
- In contrast, the set of program source files for which no “error” description is provided in the learning history includes program source files, some of which include logical errors.

3. Outcome of our Research

3.3 Logical error detection



I visually confirmed the difference information in the source file.

I was very tired.

3. Outcome of our Research

3.3 Logical error detection

TABLE I. TYPE OF LOGIC ERROR

Type	Description
Spaces	Add or delete spaces or tabs.
Comments	Add or delete comments by //.
Strings	Change the character string enclosed by " and "
Brackets	Add or delete (,), {, and }.
For statements	Modification of for statement itself and conditional part.
While statements	Modification of while statement itself and conditional part.
If statements	Modification of if statement itself and conditional part.
Else statements	Modification of else statement itself.
Println	Rewrite println, printf, print, and modification contents of ().
Semicolons	Add or delete;.
Arrays	Modification of array size and index.
Variables	Modification of variable.
Numerics	Modification of numeric number.
Substitution statements	Modification of substitution statement.
Expressions	Modification of expression.
Other	Modifications that cannot be classified as above.

As shown in the previous pages, we found that the modifications contained some types of logic errors.

In addition to these, we found that the modifications contained the logic errors in the learning history shown in this table.

3. Outcome of our Research

3.3 Logical error detection

TABLE III. NUMBER OF DETECTIONS AND PERCENTAGE FOR EACH LOGIC ERROR TYPE

Type	Num. of Detections (Percentage %)		
	2017	2018	2019
Spaces	4189 (19.94)	2735 (15.12)	2934 (14.85)
Comments	124 (0.59)	34 (0.19)	289 (1.46)
Strings	2616 (12.45)	2675 (14.78)	2410 (12.20)
Brackets	1140 (5.43)	1164 (6.43)	1228 (6.21)
For statements	2771 (13.19)	2223 (12.29)	2577 (13.04)
While statements	152 (0.72)	108 (0.60)	152 (0.77)
If statements	1453 (6.92)	1122 (6.20)	1384 (7.00)
Else statements	49 (0.23)	31 (0.17)	183 (0.93)
Println	89 (0.42)	101 (0.56)	93 (0.47)
Semicolons	869 (4.14)	649 (3.59)	649 (3.28)
Arrays	371 (1.77)	333 (1.84)	454 (2.30)
Variables	3215 (15.30)	2476 (13.68)	2390 (12.10)
Numerics	1447 (6.889)	2006 (11.09)	2313 (11.71)
Substitutions	279 (1.33)	252 (1.39)	331 (1.68)
Expressions	2220 (10.57)	2155 (11.91)	2333 (11.81)
Other	26 (0.12)	29 (0.16)	40 (0.20)
Total	21010 (100)	18093 (100)	19760 (100)

Many detections for “For statements” and “If statements” are related to program control structures. The “While statements,” which are also control structures, are used infrequently, and therefore the number of detections is small.

Many detections of changes in “Variables” and “Numbers” are registered. This is attributed to the nature of university lessons, as similar problems are solved successively.

Although many “Expressions” are detected, the logic errors contained here may require further analysis.

3. Outcome of our Research

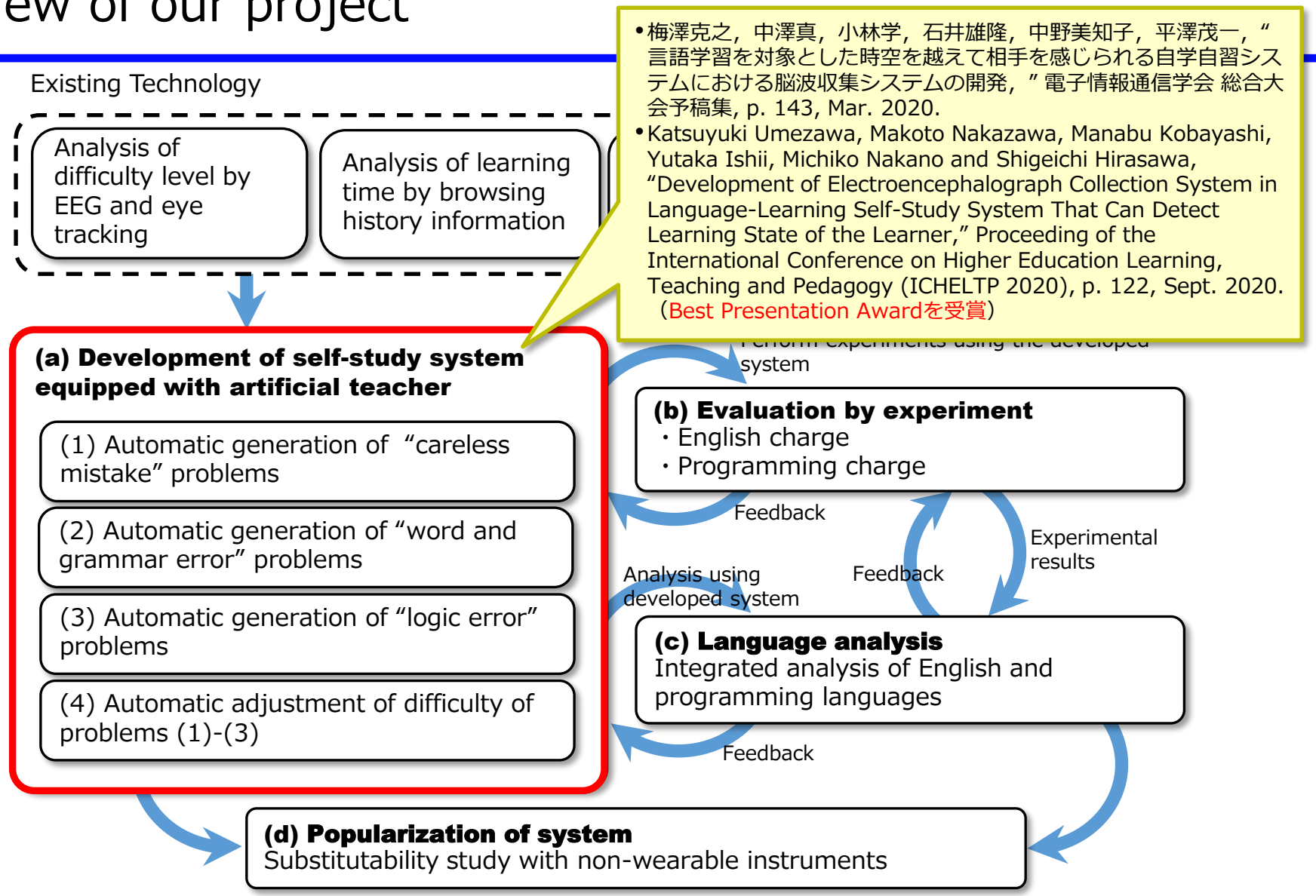
3.3 Logical error detection

Conclusion

- We were able to detect logic errors from a large volume of programming history where the compiler outputs no error information, owing to the lack of syntax errors.
- Using these results, we can extract source code containing one logical error related to (for example) the “for” statement.
- This source code can be presented to students, who can practice debugging to correct logic errors.

2. Research strategy

2.1 Overview of our project

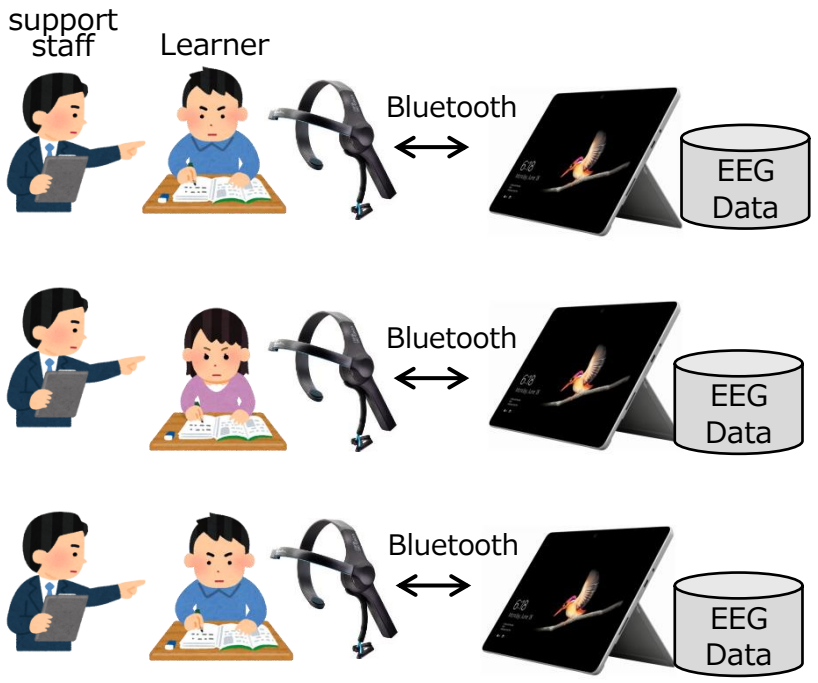


- 梅澤克之，中澤真，小林学，石井雄隆，中野美知子，平澤茂一，“言語学習を対象とした時空を越えて相手を感じられる自学自習システムにおける脳波収集システムの開発，” 電子情報通信学会 総合大会予稿集, p. 143, Mar. 2020.
- Katsuyuki Umezawa, Makoto Nakazawa, Manabu Kobayashi, Yutaka Ishii, Michiko Nakano and Shigeichi Hirasawa, “Development of Electroencephalograph Collection System in Language-Learning Self-Study System That Can Detect Learning State of the Learner,” Proceeding of the International Conference on Higher Education Learning, Teaching and Pedagogy (ICHELTP 2020), p. 122, Sept. 2020.
（Best Presentation Awardを受賞）

4. About system development

4.0 Currently

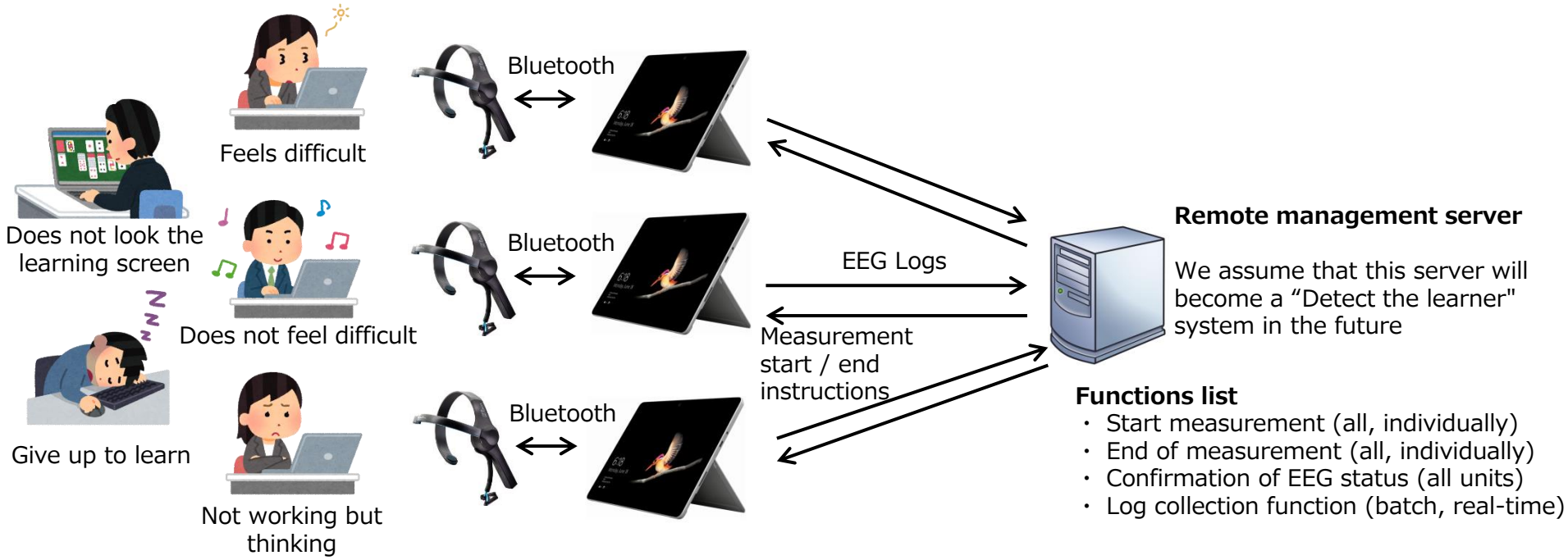
- Currently, if we want to experiment, we need as many PCs
- Measurement must be started and stopped manually by the learner or support staff



4. About system development

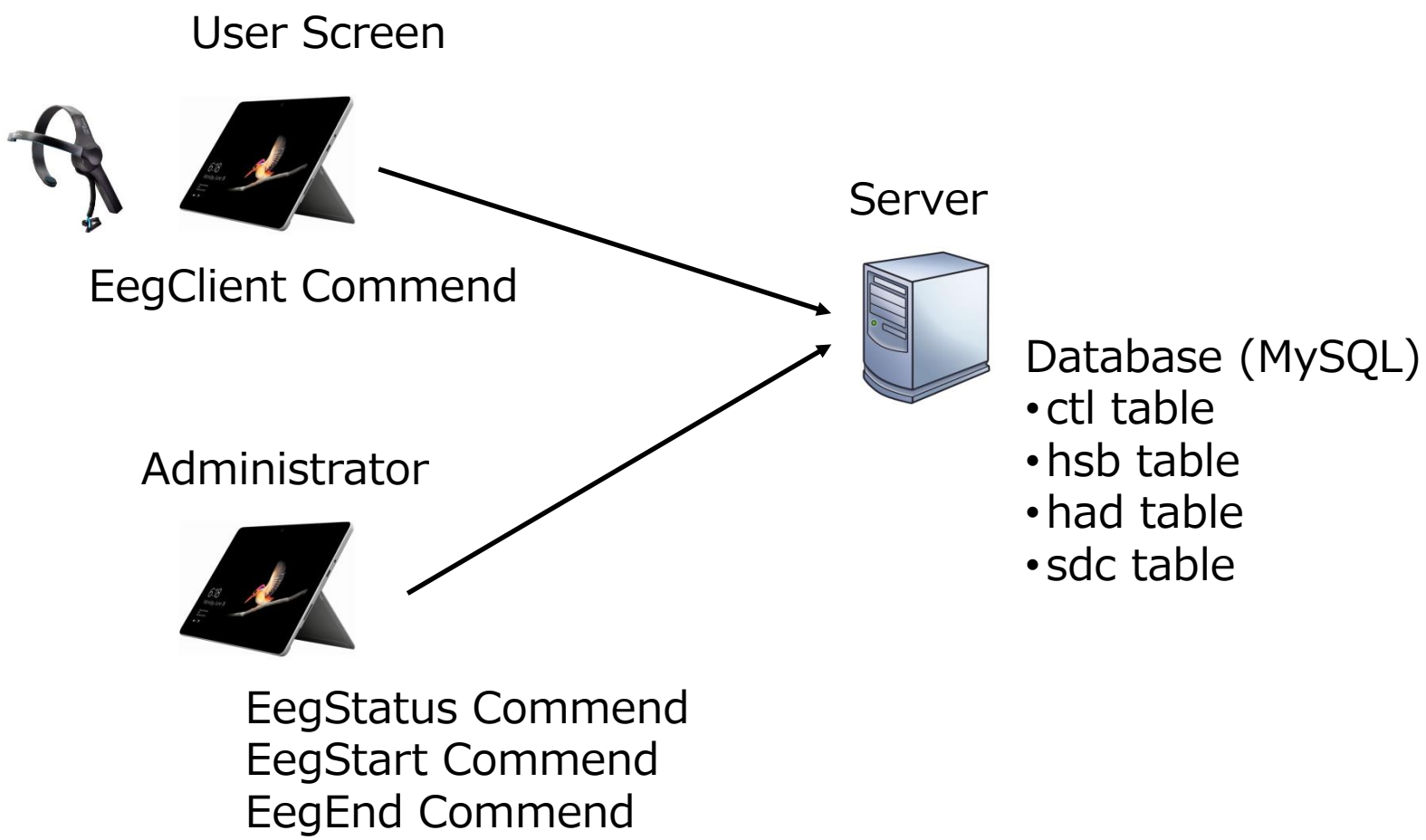
4.1 Initial version

- In order to perform the experiment smoothly, we think that a system that can centrally manage EEG measurement is necessary



4. About system development

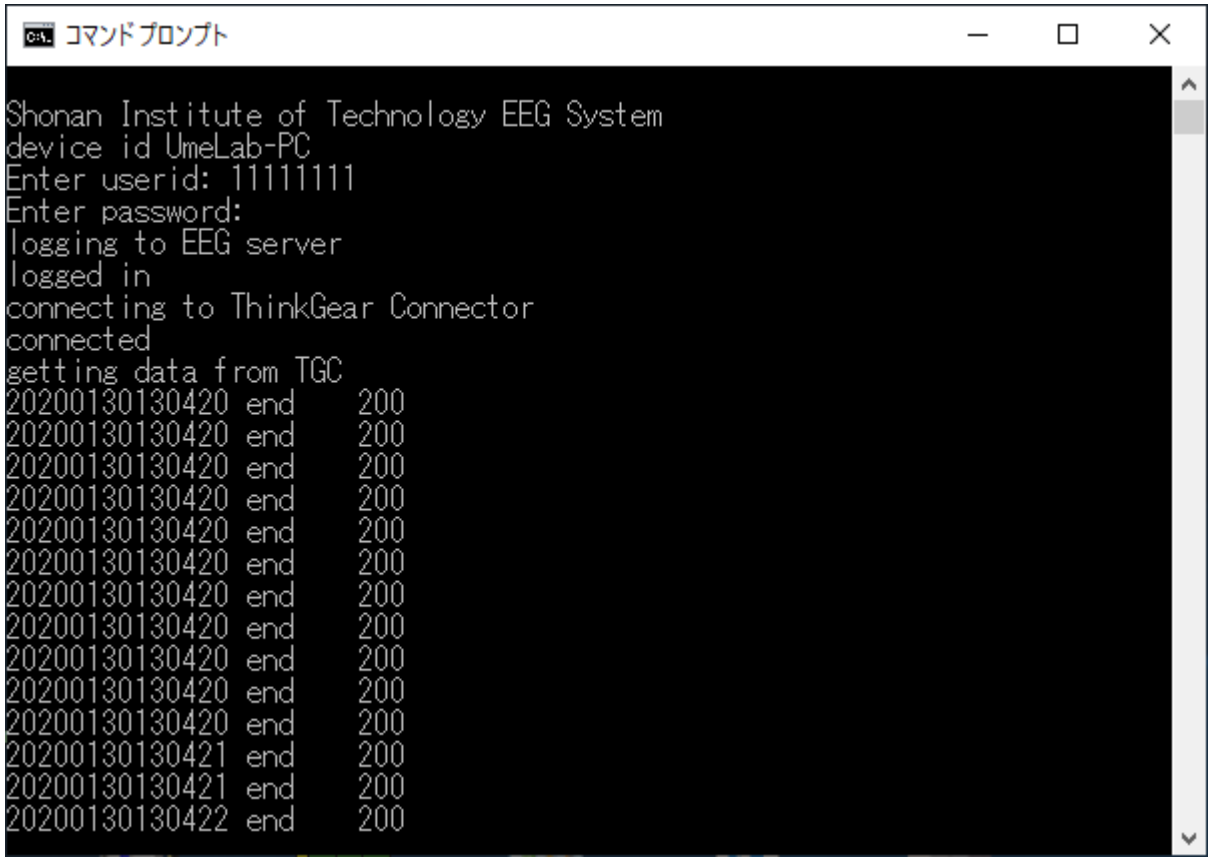
4.1 Initial version



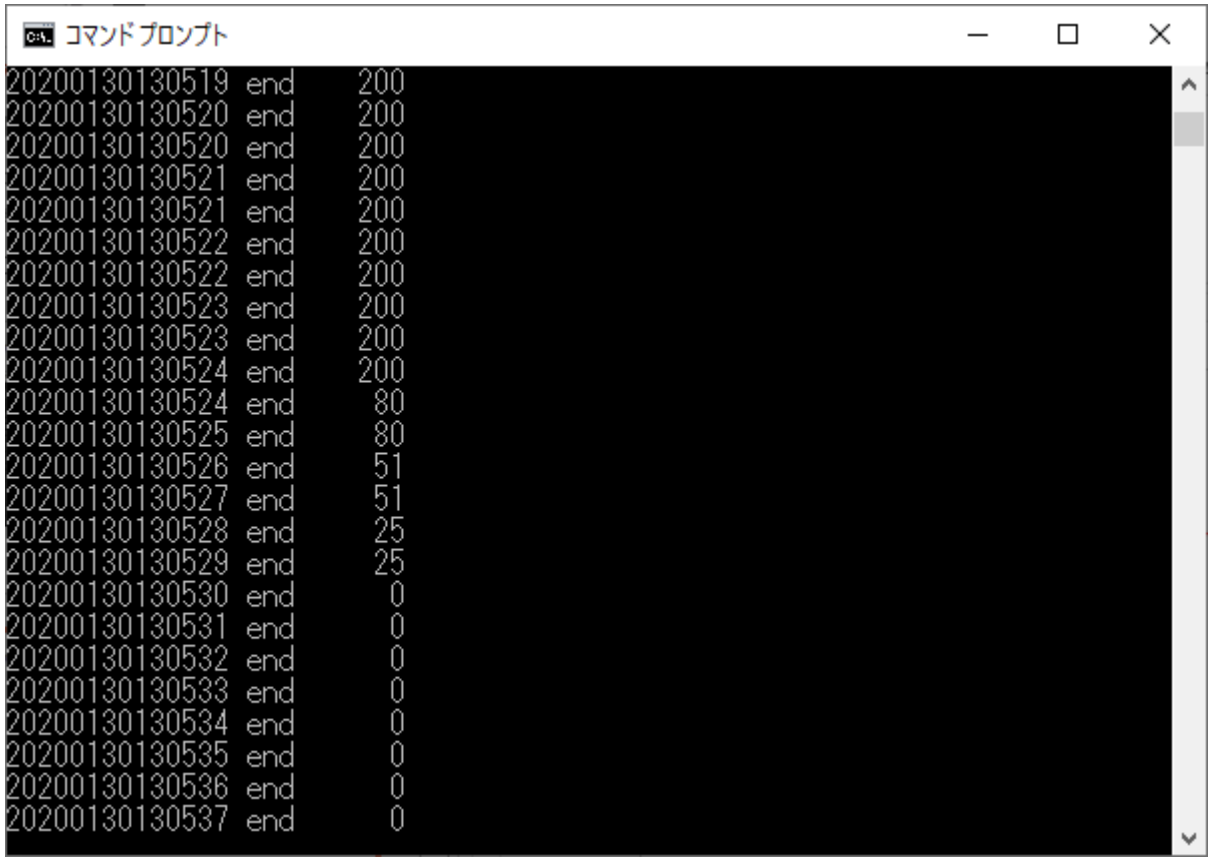
4. About system development

4.1 Initial version

User Screen just after starting EegClient Command

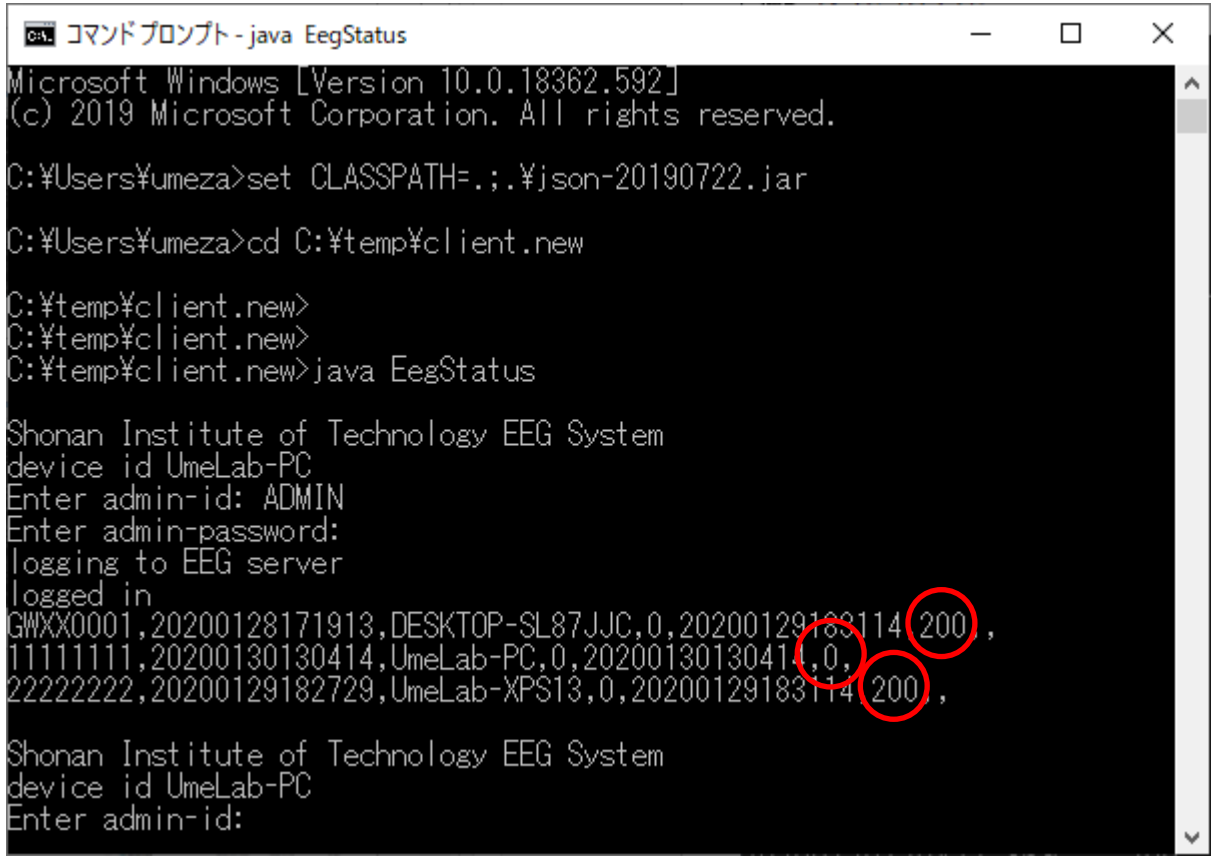


User Screen when the acquisition of brain wave begins. The value changes from 200 to 0.



4. About system development
4.1 Initial version

Administrator screen
Check the user status with the EegStatus command.



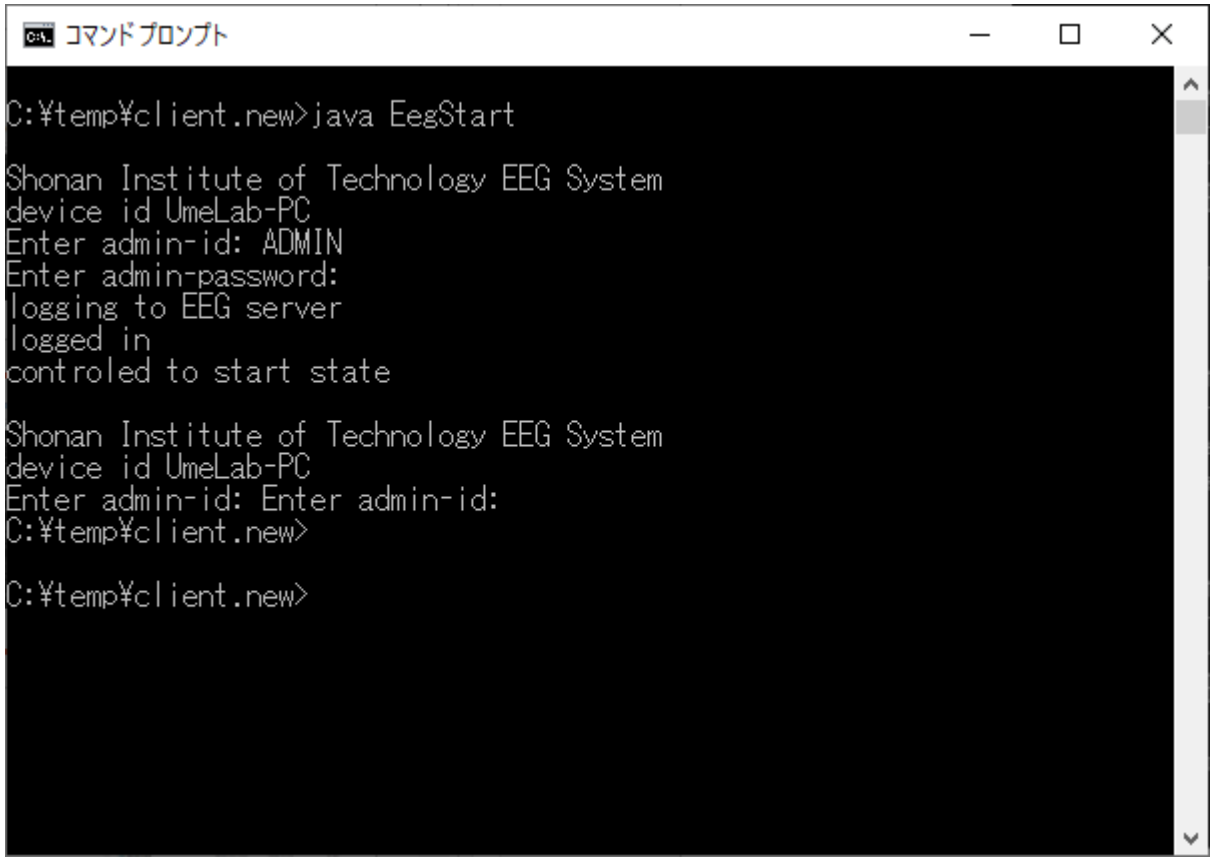
You can see that the status of user ID 11111111 is 0.
Other users remain at 200.
The administrator confirms that the status of all members has become 0, and starts the measurement with the start command on the next page.

0: brain waves are acquired normally.
200: brain waves has not been acquired due to poor signal, etc.

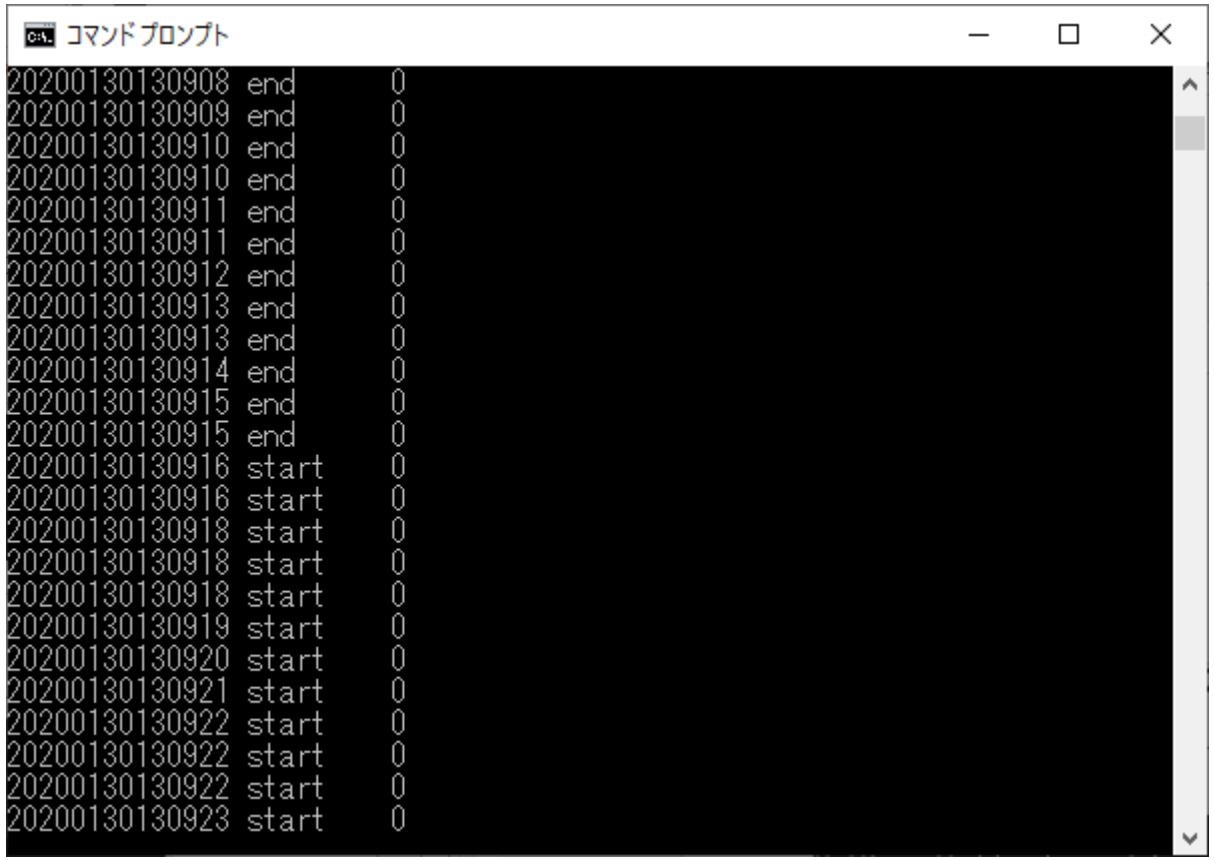
4. About system development

4.1 Initial version

Administrator Screen
Start measurement with EegStart command

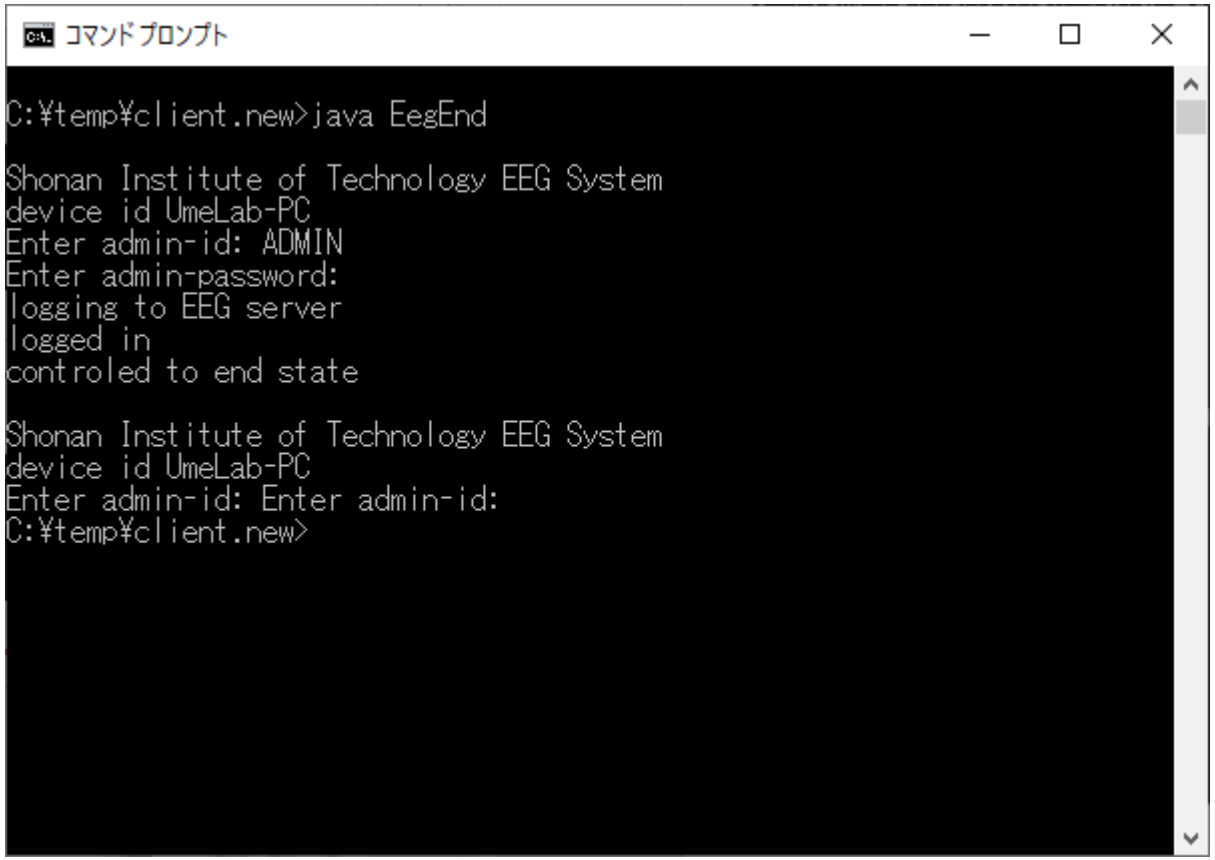


User Screen
User can confirm that the measurement has started

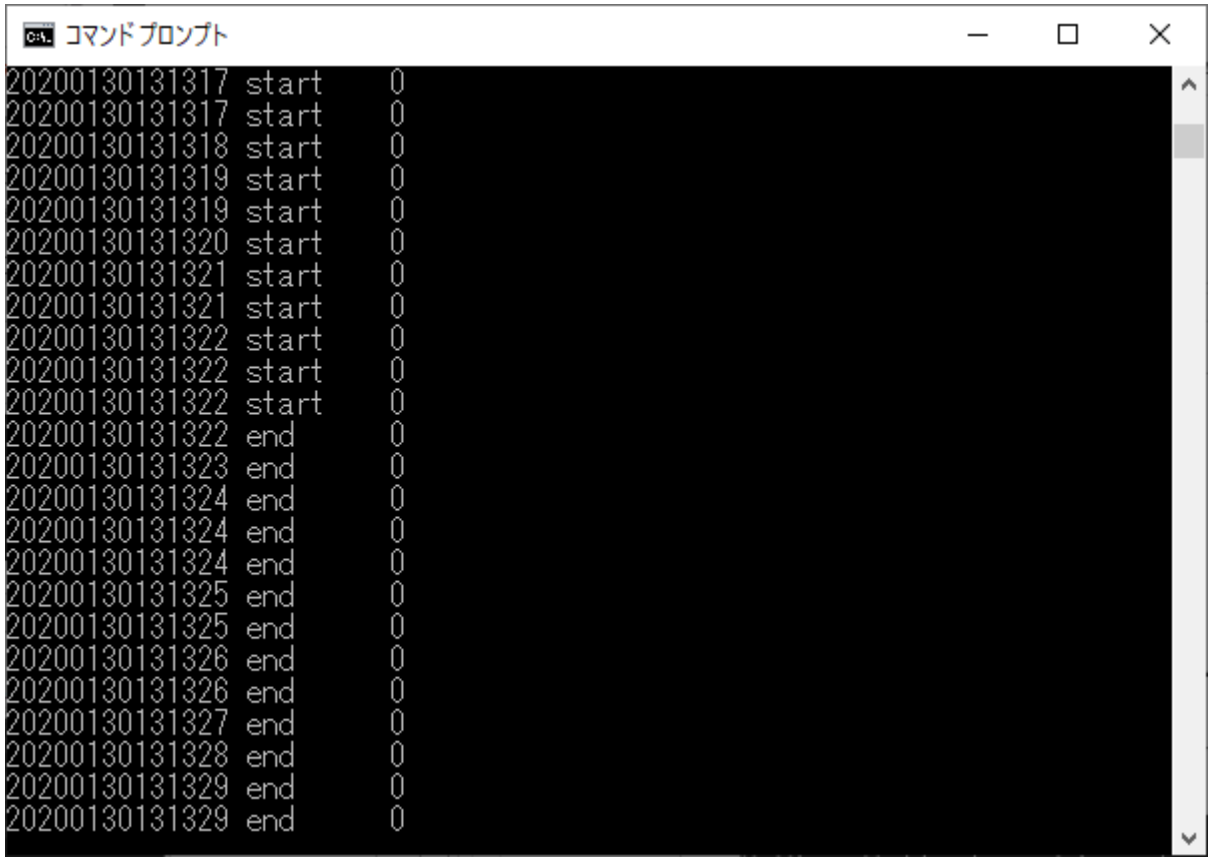


4. About system development
4.1 Initial version

Administrator Screen
Stop measurement with EegEnd command



User Screen
User can confirm that the measurement has stoped



4. About system development

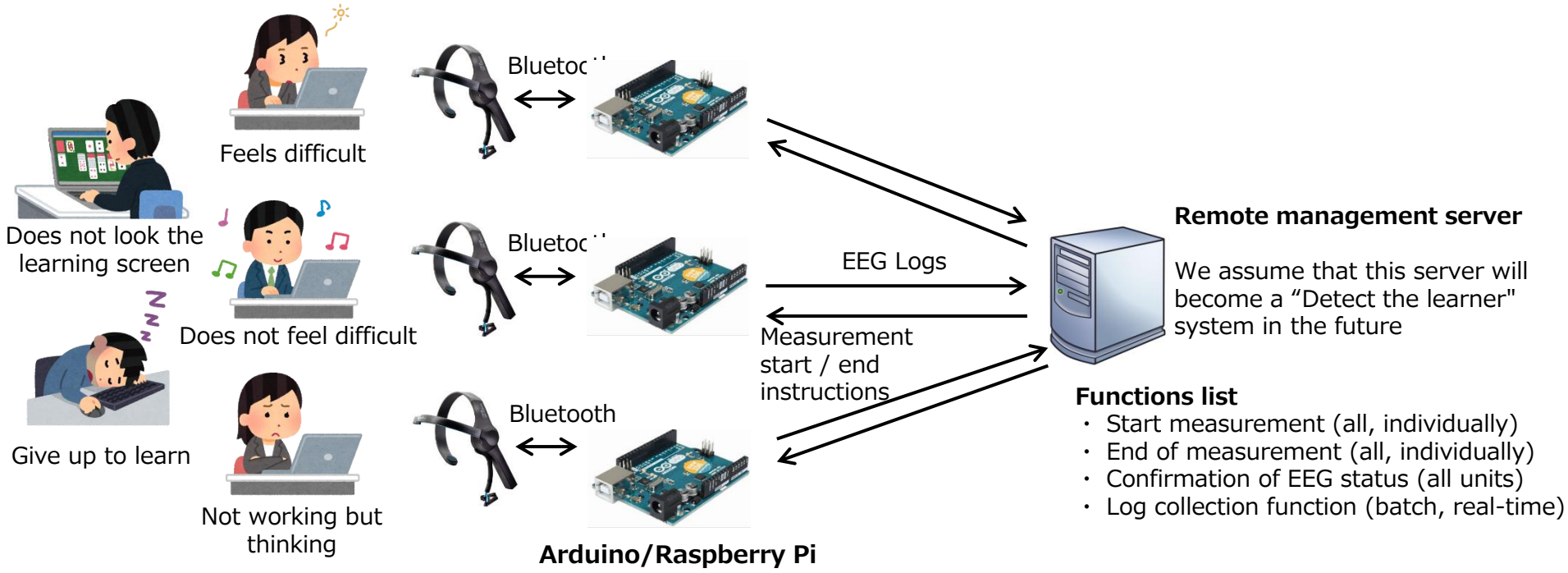
EEG data accumulated in the database of the server.

sdccrtdt	sdcupddt	attension	meditation	delta	theta	lowAlpha	highAlpha	lowBeta	highBeta	lowGamma	highGamma	HostSABSNo	DevId
2020-01-29 18:17:43	2020-01-29 18:17:43	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:17:43	2020-01-29 18:17:43	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:17:43	2020-01-29 18:17:43	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:17:43	2020-01-29 18:17:43	57	61	366064	32937	12909	12179	6119	5337	4320	599	11111111	UmeLab-PC
2020-01-29 18:17:44	2020-01-29 18:17:44	41	44	142244	68443	2487	5417	10939	13522	4533	3628	11111111	UmeLab-PC
2020-01-29 18:17:45	2020-01-29 18:17:45	47	44	674140	42364	5187	15516	2325	10148	13378	2418	11111111	UmeLab-PC
2020-01-29 18:17:46	2020-01-29 18:17:46	57	34	64750	64942	5764	6066	16259	34241	23844	17508	11111111	UmeLab-PC
2020-01-29 18:30:45	2020-01-29 18:30:45	0	0	1681000	1202219	526665	234242	214614	578354	492786	567781	22222222	UmeLab-XPS13
2020-01-29 18:30:46	2020-01-29 18:30:46	100	20	1172069	729880	91692	50703	37211	97643	70474	19012	11111111	UmeLab-PC
2020-01-29 18:30:46	2020-01-29 18:30:46	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:46	2020-01-29 18:30:46	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:46	2020-01-29 18:30:46	0	0	425373	548621	249872	234027	39364	143406	135219	158474	22222222	UmeLab-XPS13
2020-01-29 18:30:47	2020-01-29 18:30:47	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:47	2020-01-29 18:30:47	78	48	868616	164951	112798	37869	5301	13078	27162	6401	11111111	UmeLab-PC
2020-01-29 18:30:47	2020-01-29 18:30:47	0	0	33001	48136	19512	74989	25638	34913	28268	36047	22222222	UmeLab-XPS13
2020-01-29 18:30:48	2020-01-29 18:30:48	0	0	1659695	556822	793343	335719	483363	617801	384457	406100	22222222	UmeLab-XPS13
2020-01-29 18:30:48	2020-01-29 18:30:48	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:49	2020-01-29 18:30:49	74	57	20908	27115	12588	6492	4061	8281	4533	3017	11111111	UmeLab-PC
2020-01-29 18:30:49	2020-01-29 18:30:49	0	0	562224	989683	26249	233702	83982	185761	90329	259567	22222222	UmeLab-XPS13
2020-01-29 18:30:49	2020-01-29 18:30:49	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:50	2020-01-29 18:30:50	57	67	406698	67050	10571	16899	2797	3949	1729	1644	11111111	UmeLab-PC
2020-01-29 18:30:50	2020-01-29 18:30:50	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:51	2020-01-29 18:30:51	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:51	2020-01-29 18:30:51	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:51	2020-01-29 18:30:51	74	63	1992370	145265	22716	93028	45948	26608	11532	18266	11111111	UmeLab-PC
2020-01-29 18:30:51	2020-01-29 18:30:51	0	0	923052	1086177	840965	374927	62644	92059	30153	274717	22222222	UmeLab-XPS13
2020-01-29 18:30:52	2020-01-29 18:30:52	83	67	549709	233946	87827	65089	29494	55123	54906	24283	11111111	UmeLab-PC
2020-01-29 18:30:52	2020-01-29 18:30:52	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:52	2020-01-29 18:30:52	0	0	991038	1842370	348303	1066027	126501	124429	69864	242281	22222222	UmeLab-XPS13
2020-01-29 18:30:53	2020-01-29 18:30:53	67	69	2693500	201877	113117	36008	23648	26070	80234	10250	11111111	UmeLab-PC
2020-01-29 18:30:53	2020-01-29 18:30:53	0	0	189062	1771477	85161	175936	163989	57739	24114	236864	22222222	UmeLab-XPS13
2020-01-29 18:30:53	2020-01-29 18:30:53	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:54	2020-01-29 18:30:54	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:54	2020-01-29 18:30:54	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:54	2020-01-29 18:30:54	67	75	3827210	420166	205223	61683	115756	29602	17402	21665	11111111	UmeLab-PC
2020-01-29 18:30:54	2020-01-29 18:30:54	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:54	2020-01-29 18:30:54	0	0	902578	2459621	681444	481918	204892	348893	158818	237942	22222222	UmeLab-XPS13
2020-01-29 18:30:55	2020-01-29 18:30:55	67	75	871471	232974	5362	7526	18567	6182	1781	2070	11111111	UmeLab-PC
2020-01-29 18:30:55	2020-01-29 18:30:55	0	0	552436	317437	120133	11329	45932	63942	18246	68926	22222222	UmeLab-XPS13
2020-01-29 18:30:56	2020-01-29 18:30:56	75	67	2311815	176418	72889	53140	140513	48586	20191	19437	11111111	UmeLab-PC
2020-01-29 18:30:56	2020-01-29 18:30:56	0	0	838979	898854	369751	656341	103219	189951	79201	163319	22222222	UmeLab-XPS13
2020-01-29 18:30:57	2020-01-29 18:30:57	66	67	1603175	127960	48247	27648	14657	17119	13844	2603	11111111	UmeLab-PC
2020-01-29 18:30:57	2020-01-29 18:30:57	0	0	767223	210103	124297	429956	191065	83605	262650	163062	22222222	UmeLab-XPS13
2020-01-29 18:30:57	2020-01-29 18:30:57	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC
2020-01-29 18:30:58	2020-01-29 18:30:58	0	0	0	0	0	0	0	0	0	0	11111111	UmeLab-PC

4. About system development

4.2 Next version

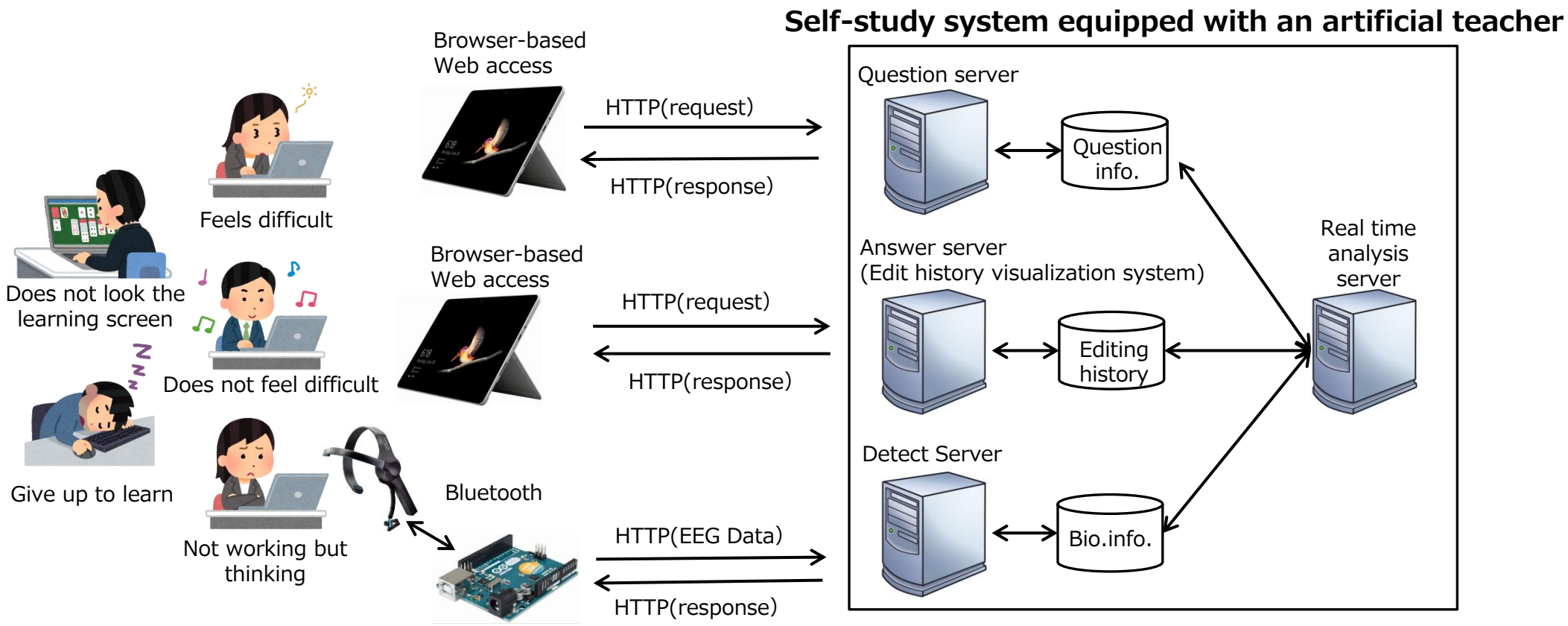
- We want to realize a user-side system at a low cost
- We want to realize it with cheap devices such as Raspberry Pi and Arduino.
- We need middleware driver for Arduino / Raspberry Pi to get EEG.



4. About system development

4.3 Final version

- Finally, we will develop a self-study system equipped with an artificial teacher that integrates "question server", "answer server", and “detect server".



5. Conclusion and future work

Conclusion

- In this study, we succeeded in determining careless mistakes, extracting grammatical errors, and analyzing logical errors as part of our research on self-study systems for language learning.
- Furthermore, we developed a system that can efficiently collect brain waves from the participants of the experiment.

Future work

- In the future, we plan to research evaluation experiments and integrated analysis of English and programming languages as well as research on possible substitutes with non-wearable measuring instruments to popularize the system.

About Research Ethics

- The Research Ethics Committee of Shonan Institute of Technology has approved these experiments.
- We also have received consent to participate in this experiment from participants and their parents.

Acknowledgment

- Part of this research result was carried out as a part of research project “Research on e-learning for next-generation” of Waseda Research Institute for Science and Engineering, Waseda University.
- Part of this work was supported by JSPS KAKENHI Grant Number JP19H01721, 19K04914, JP17K01101 and JP16K00491, and Special Account 1010000175806 of the NTT Comprehensive Agreement on Collaborative Research with Waseda University Research Institute for Science and Engineering.
- Research leading to this paper was partially supported by the grant as a research working group “ICT and Education” of JASMIN.

湘南工科大学
SHONAN INSTITUTE OF TECHNOLOGY

Thank you for your attention

umezawa@info.shonan-it.ac.jp