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Design and Implementation of ELAS in AI education (Experiential K-12 AI education Learning Assessment System)

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Abstract

Evaluation as learning is important for the learner competency test, and the applicable method is studied. Assessment is the role of diagnosing the current learner's status and facilitating learning through appropriate feedback. The system is insufficient to enable process-oriented evaluation in small educational institute. Focusing on becoming familiar with the AI through experience can end up simply learning how to use the tools or just playing with them rather than achieving ultimate goals of AI education. In a previous study, the experience way of AI education with PLAY model was proposed, but the assessment stage is insufficient. In this paper, we propose ELAS (Experiential K-12 AI education Learning Assessment System) for small educational institute. In order to apply the Assessment factor in in this system, the AI-factor is selected by researching the goals of the current SW education and AI education. The proposed system consists of 4 modules as Assessment-factor agent, Self-assessment agent, Question-bank agent and Assessment -analysis agent. Self-assessment learning is a powerful mechanism for improving learning for students. ELAS is extended with the experiential way of AI education model of previous study, and the teacher designs the assessment through the ELAS system. ELAS enables teachers of small institutes to automate analysis and manage data accumulation following their learning purpose. With this, it is possible to adjust the learning difficulty in curriculum design to make better for your purpose.

Keywords: *AI education, Experience education, Assessment System, AI literacy*

1. INTRODUCTION

Recently, as AI education is emphasized, research and policies for the formation and support of related curriculum is being promoted worldwide. The Ministry of Education will introduce 'AI education' in regular subjects for K-12 students from 2025[1]. AI education for K-12 subjects focuses on familiarization with AI, and the need for AI experience is relatively high [2]. It is recommended to practice in a computing environment and experiential activities as UA (Unplugged Activity). In the AI curriculum for elementary, middle school students and early learners should be preceded by real-life examples and learning that can touch CT (computational thinking) and artificial intelligence. Better than AI algorithms, mathematical formulas, and programming concepts. As platforms used in AI education, there are Entry, Teachable Machine, and ML4kids [3][4][5]. However, the evaluation of student understanding is insufficient.

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In this paper, ELAS (Experiential K-12 AI education Learning Assessment System) for small institute is proposed. The AI education applied in this study is block coding based on artificial intelligence experiential-based [6] applying the PLAY model. And ELAS is a system that can quantitatively evaluate understanding and coding performance in connection with experiential AI education. Although LMS and existing evaluation systems can be applied, there are many unnecessary functions to use in small size institute and the cost burden. In addition, the criteria for evaluating the learning level do not fit into the focus of AI education. Therefore, there is a need for an evaluation system that considers usability in a small sized institute. It is possible an integrate instruction and assessment to ensure process-oriented assessment.

2. SYSTEM OVERVIEW

According to constructivism, learning is constructed in the learner's head based on the learner's experiences [7]. Even if you learn the same content, each person has a different way of understanding, and they can grow through feedback. The Self-assessment system is an online tool that possible self-recognize of own learning situation and provides feedback for teachers and students to achieve their goals. The proposed system consists of 4 agents as follows.

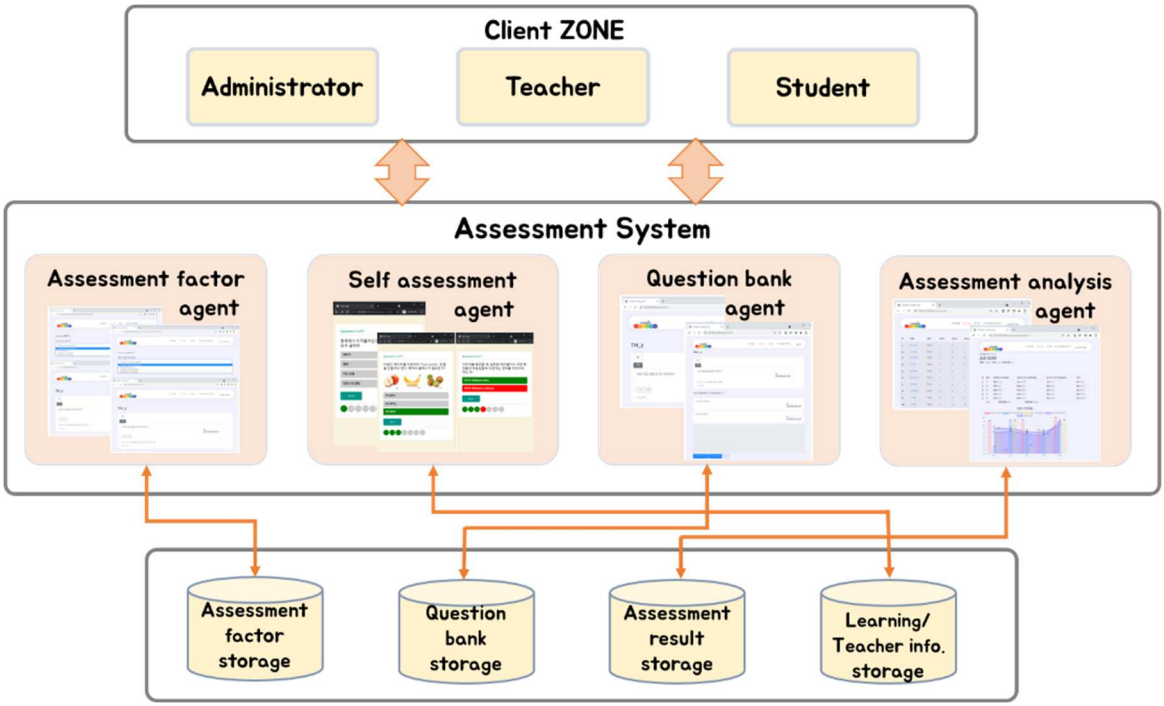


Figure 1. Configuration of the proposed system

<Figure 1> is the configuration of the proposed system in this paper. ELAS is mainly consists of Assessment-factor agent, Self-assessment agent, Question bank agent and Assessment analysis agent. Each agent is configured to be organically linked according to the roles of teachers, students and administrators.

- Assessment-factor agent: This agent manages assessment factors for AI questions. This is to measure the response of the question and teachers select the assessment-factor related to a question in question bank agent.
- Self-assessment agent: This agent checks how well each student has learned and understood their selected subjects.

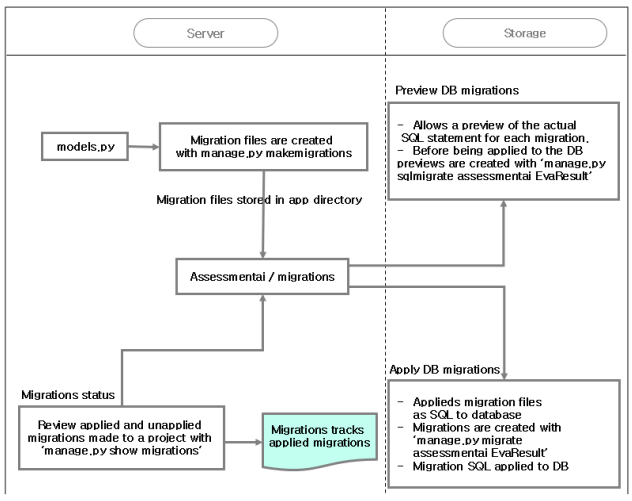
- Question bank agent: This agent manages quizzes made by teacher. Teachers can also make Quiz previews and share them with other teachers.
- Assessment analysis agent: This agent manages quiz test-results and provide teachers individual student scores and data analyzed by assessment-factor.

3. PROPOSAL ELAS FOR ASSESSMENT SYSTEM

Evaluation as learning is important for the learner competency test, and the applicable method is studied. The trend of the times is changing rapidly, and the speed of learning is also important. As an educational model to which AI education is applied, the PLAY education model is used. The Play education model combines the accelerated learning theory and the multiple intelligence theory that human intelligence is composed of multiple abilities [3]. It conducts experiential AI education applying the PLAY education model, and enables AI education through the assessment system. We propose an ELAS that the curriculum and assessment can be conducted offline and online. Assessment is the role of diagnosing the current learner's status and facilitating learning through appropriate feedback. The evaluation systems used in class include Kahoot[8] and Plickers[9]. It has the advantage that it can be accessed during class and can be evaluated in the form of a quiz question. However, there is a disadvantage that the flow of individual learning assessment cannot be seen at a glance. Feedback is insufficient so that students can learn during self-assessment, and individual assessment is not managed cumulatively. Assessment factors cannot be set, and the number of optional questions is limited to 4 or less when taking a quiz. Therefore, in this paper, an improved assessment system is proposed.

ELAS selects assessment-factors to set the teaching and learning direction, and the administrator manages the assessment-factors. The teacher provides feedback provides feedback on the overall assessment results of the participating students in each class and each assessment element. It is designed so that students can learn by exposing the correct answer to each question even during self-assessment. AI-factors are selected as ROP (Recognition of the problem), AEI (Analysis and evaluation of information), and OCI (Organization and creation of information).

Table 1. Flow chart of each agent

<table>
<tr>
<td><Algorithm 1. Assessment Factor>
 
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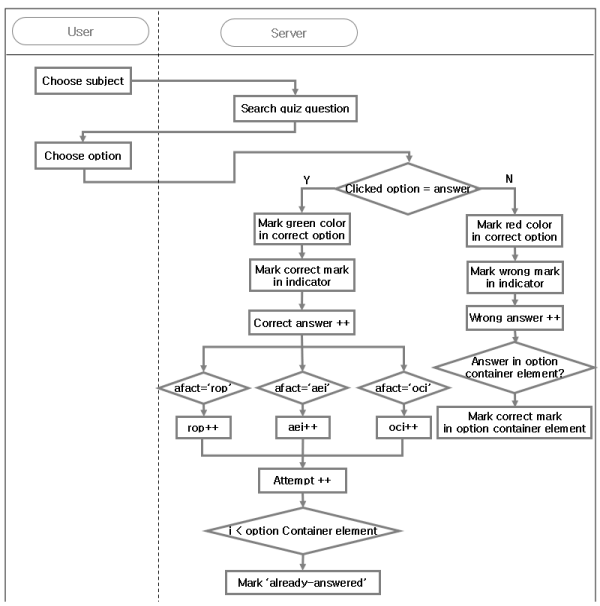
<td><Algorithm 2. Answer indicator>
 
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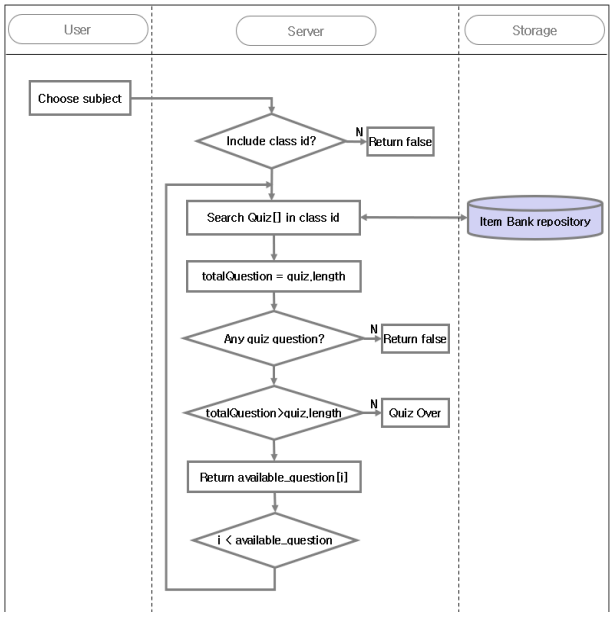
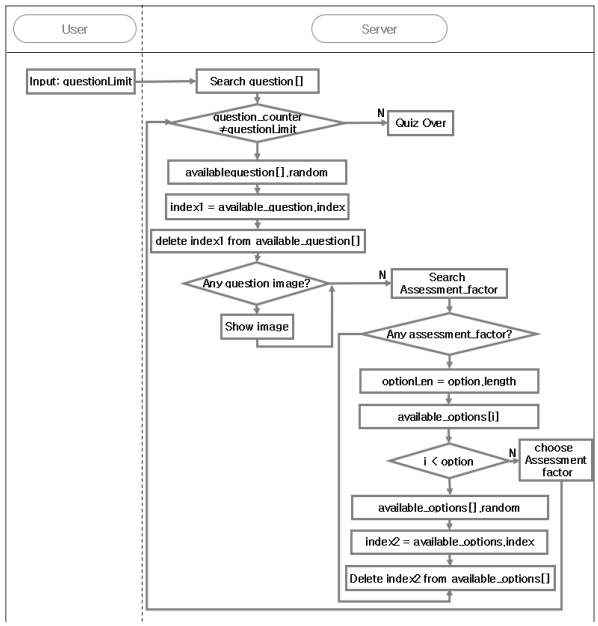
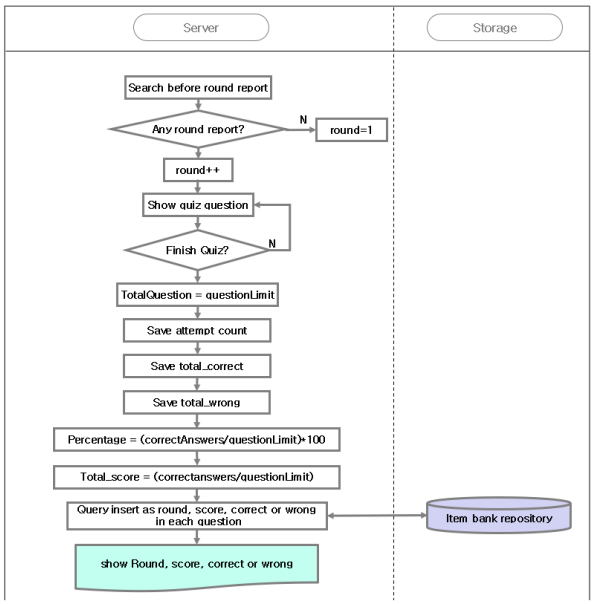
<Algorithm 3. Available Question>



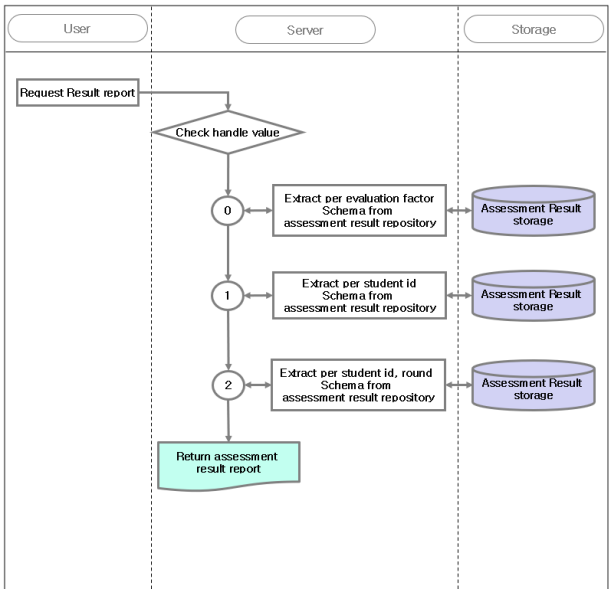
<Algorithm 4. New Question>



<Algorithm 5. Quiz result >



<Algorithm 6. Make report >



<Table1> shows flow chart of each agent as Assessment-factor agent, Self-assessment agent, Question-bank agent and Assessment -analysis agent. It designed to enable system access according to the roles of administrator, teacher and student. Each flow chart shows the algorithm below.

<Algorithm 1> is the algorithm of the Assessment-factor agent. Through the algorithm, assessment factors can be input/output and managed by the system. The algorithm name is Assessment Factor. The input is the models instance reference and the output is the models' object. It can be accessed by the administrator and has insert, edit, and delete functions. The Ai-factor designed by the administrator is selected by teacher as an assessment item for each question when questioning. It is an algorithm that stores data by creating a table so that the database can be used in the Assessment factor model.

<Algorithm 2> is the algorithm of the Self-assessment agent. The self-assessment agent manages information according to the student's learning assessment. The student selects a subject and conducts self-assessment in the classroom, which is the corresponding teacher. It is an algorithm that provides feedback of correct and incorrect answers to students during self-assessment. The algorithm name is Answer indicator. The inputs are question list, option list, model select query, current answer reference. And the output is the result of current attempt question.

<Algorithm 3> is the algorithm of the Question-bank agent. Bring question that can be available Question as a quiz. The algorithm name is Available Question. The inputs are class id, quiz list, question list. And the output is the available questions list.

<Algorithm 4> is the algorithm of the Question-bank agent. Questions and option list are drawn at random from the question bank. The algorithm name is New Question. The inputs are question limit, available, question list, available options list. And the outputs are current question, available option list.

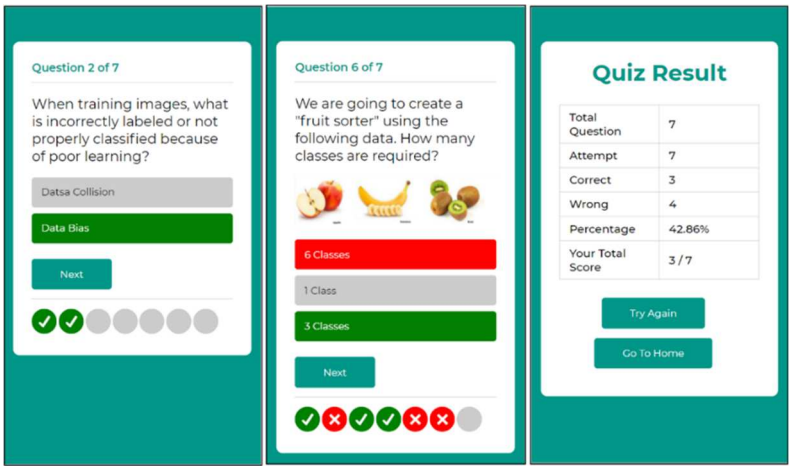
<Algorithm 5> is the algorithm of the Assessment-analysis agent. Each assessment-factor's score and total score of Self-assessment are stored in the storage. The algorithm name is Quiz result. The inputs are round, question limit, elements after self-assessment. The output is result factors after self-assessment and it save in repository.

<Algorithm 6> is the algorithm of the Assessment-analysis agent. Generate teacher feedback. It is created as a report on the student's assessment and could check the assessment analysis. The algorithm name is Make report. The input is reshandle as report type option, and outputs are class object, student result object, round result object.

4. IMPLEMENTS

This system is divided into administrator, teacher and student. Students can sign up for classes in this system and choose to self-assessment menu using a tablet, PC or mobile phone. The administrator manages the assessment-factor elements, and the teacher can manage the students of the class in charge of the subject or access question bank for create quiz.

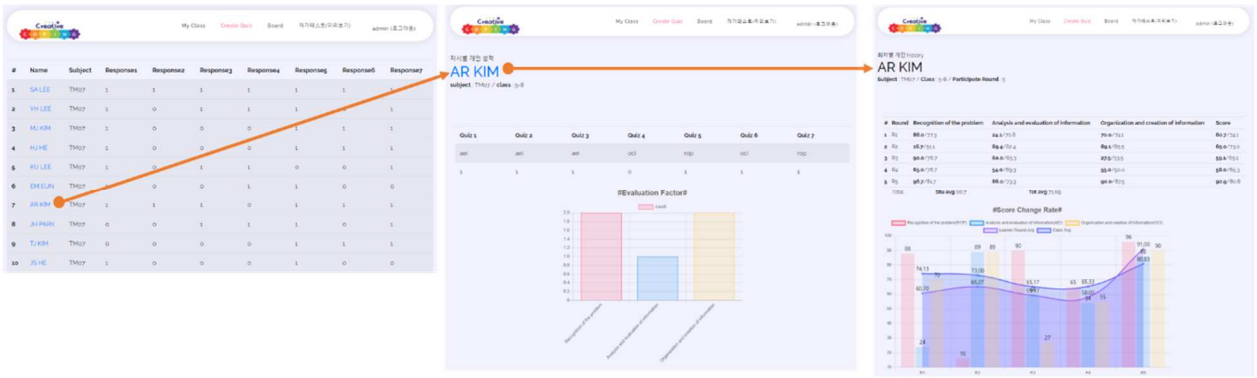
The proposed system uses DB browser for SQLite version 3.12.2, Django framework, and chartJS API for report visualization in windows 10 64-bit environment.



(a) (b) (c)

Figure 2. UI of Self-assessment for student

<Figure 2> shows the UI of self-assessment. At the top, the total number of questions and the current number are displayed. The students can know the progress by themselves. In (a), when the student selects the correct answer, the indicator at the bottom displays green color as the correct answer mark on the circle corresponding to the current number. (b) is the UI when an image is uploaded when submitting a question. If a student selects an incorrect answer, the student's selection is displayed in red color, and the correct answer is displayed in green at the same time. Through this, even if you choose the wrong answer, student can know what the correct answer is. Also, in the indicator at the bottom, red color is displayed as an incorrect answer in the circle corresponding to the current number. Through self-assessment, it is possible to self-check how many of the total questions are wrong. When all quizzes are finished, student can check the results of the round as in (c).



(a) (b) (c)

Figure 3. UI of Assessment-analysis for teacher

<Figure 3> shows the UI of assessment-analysis. (a) is the list of students participating in the current round and the score for each question. (b) visualizes the selected student's score for the round and each assessment-factor element. (c) shows the history of the selected student. Teacher can check the score and statistics of the round student participated in.

5. CONCLUSION

In this paper, ELAS (Experiential-based artificial intelligence Learning Assessment System) was proposed. Although the assessment stage of the existing artificial intelligence experiential education is insufficient. It was difficult for small educational institute to understand each student's understanding of AI. ELAS linked to class enables individualized assessment through online and offline linkage, and teacher feedback is provided to achieve student goals.

The teacher directly designs the assessment and reflects the assessment-factors when creating quiz. Student self-diagnosis is a powerful mechanism for improving student learning. Through self-assessment, students self-recognize their own understanding and ability of concepts acquired through artificial intelligence experiential activities. The system stores and manages the student's learned subjects, attendance, and assessment records. Teachers can evaluate each student's progress through the provided statistics for each student's assessment-factor. It is possible to manage acquired concepts, grasp the level of understanding, and achieve learning goals and it is provided based on accumulated data. Through this, the learning difficulty and learning module can be supplemented with curriculum design applying the education model. In addition, a curricular model by teaching community is possible because the teacher's assessment quiz is shared. If necessary, data-based counseling and briefing support will be expanded. For future research, it is necessary to

study the application of evaluation system according to AI education in which other education models are applied to teaching and learning.

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