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# A Proposal and Evaluation of Learning Advising using a Generative AI

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**Abstract:** In this paper, we propose and evaluate a method in which learner's learning history and information about goal setting and reflection are provided as prompts to Large Language Models (LLM) that enables automated learning advice generated. The proposed approach allows us to generate advice messages that are relevant to the learner's learning properties, using learners' own sentences for reflections and goal settings. The generated advice is evaluated from the point of view whether it is similar to the actual teacher's one.

**Keywords:** Autonomous Learning, Flipped Classroom, Generative AI, GPT, LLM

## 1. Introduction

Japanese higher education has been increasingly focusing on autonomous learning to cultivate abilities of problem solving capable of handling unpredictable circumstances. We previously indicated effectiveness of an online flipped classroom model to foster the autonomous learning (Takano et al., 2022). However, there remains a problem that for those unfamiliar with self-guided learning, developing autonomy can be challenging. Ideally, educators should provide advice along learning situations of each student, but doing this weekly is practically difficult. Recent advancements in Large Language Models (LLM) like GPT have expanded the use of generative AI across various sectors, including education.

In this study, we investigate the feasibility of using generative AI for personalized learning advice. To obtain the advice, we incorporate data from the Learning Management System (LMS) and text information about students' goals and reflections. The generated advice is evaluated from the point of view whether it is similar to the actual teacher's one, taking into account the learner's properties and the blending of reflection and goal setting.

## 2. Class Model

The class model used in this study is an online flipped classroom model. In preparation, learners will work on the textbook, exercises, comprehension tests, and assignments. All the preparatory work will be done online. Learners' autonomy is important in this model. Learners can participate in group work during class time to discuss the results of their preparatory work while those with a low level of understanding can choose a "basic class" to supplement their knowledge. They are strongly recommended to reflect on their learning attitude and process after the class time. setting up the next week's goals. The learning advice automatically generated in this study is designed to assist in setting goals for the next week. We anticipate a process where learners, after reflecting on their learning, check the advice and set goals for the next week.

## 3. Automated Learning Advising

In this study, we propose a method in which learner's learning history and information about goal setting and reflection are provided as prompts to LLM that enables automated learning advice generated. The prompts sent to the LLM consist of three elements: the role of the conversation model, the learner's information, and the output format, as shown in Figure 1. The role includes teachers' instruction to provide advice on appropriate goal setting for a self-regulated learning. This is pre information used for the advising. The learner's information includes the learning history as well as goal setting and reflection that change, depending on learners. The output format includes the sentence definition of output form for the generated advice, with instructions based on four themes: "Introduction," "Current situation," "Potential for future growth," and "Towards setting goals for next week." The length of each theme should be around 2 to 3 sentences, and a brief description of what should be conveyed in each theme is provided.

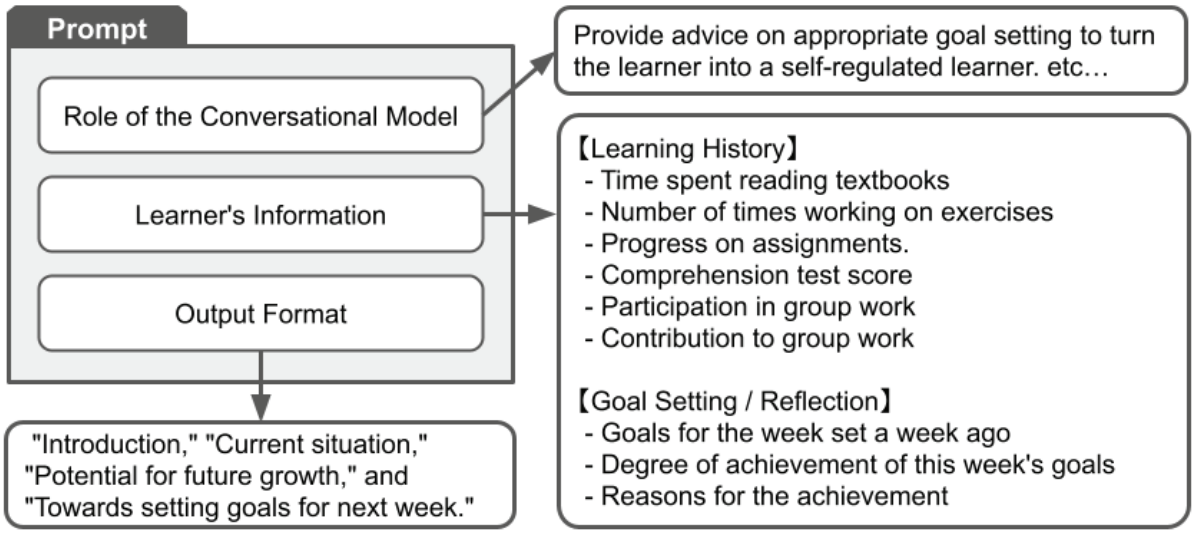


*Figure 1.* Schematic of prompts given to LLM.

## 4. Evaluation and Results

The evaluation was conducted using data from a single session of the "C Programming" course held at University A in the 2021 academic year. This class was attended by 90 students. The advice sentences were generated by sending prompts, to the LLM, as shown in Figure 1. As the LLM, we utilized the dialogue-based language model gpt-3.5-turbo (temperature=0.7) provided by OpenAI. The verification was carried out from two perspectives: "Are the advice sentences considering the learner's characteristics?" and "Are the advice sentences considering the reflection and goal setting?"

First, learners were classified on basis of learners' learning features that are determined from the principal component analysis and K-means clustering using the six items listed in "Learning History" shown in Figure 1. As a result, four clusters representing the learning features were created: "Good Progress" "Textbook-intensive" "Exercise-intensive" and "Stagnant". Table 1 shows the relationship between each cluster and its features. The symbols in the table indicate the achievement level of each item, in the order of "◎, ○, △, ×". In the automatic learning advising, it is required to generate advice to improve the items with low achievement in each cluster.

Next, we checked that the advice is generated in consideration of the learner's characteristics. The results of the analysis for each cluster (learning property) are shown in Table 2. The values in Table 2 show the percentage of advice that correspond to each learning history item. Comparing Table 1 with 2, we found that the advice is given more often to items at lower achievement, such as "△, ×".

Table 1. *Learner characteristics for each cluster*

| Cluster | Textbooks | Exercises | Test score | Assignments | Participation in GW | Contribution to GW |
|---|---|---|---|---|---|---|
| Good Progress | △ | △ | ○ | ◎ | ◎ | ◎ |
| Textbook-intensive | ◎ | △ | ○ | ○ | ○ | ○ |
| Exercise-intensive | △ | ◎ | ◎ | △ | △ | △ |
| Stagnant | △or× | △or× | × | △or× | × | × |

◎:Very high achievement, ○:Highly accomplished, △:Not very much, ×:Low achievement
※GW stands for Group Work.

Table 2. *Percentage of mentions of each item in automated study advising*

| Cluster | Textbooks | Exercises | Test score | Assignments | Participation in GW | Contribution to GW | Number of learners |
|---|---|---|---|---|---|---|---|
| Good Progress | 78.00% | 76.00% | 20.00% | 10.00% | 22.00% | 26.00% | 50 |
| Textbook-intensive | 33.33% | 100.00% | 33.33% | 0.00% | 33.33% | 33.33% | 3 |
| Exercise-intensive | 71.43% | 0.00% | 0.00% | 14.29% | 42.86% | 28.57% | 7 |
| Stagnant | 90.00% | 80.00% | 16.67% | 46.67% | 86.67% | 13.33% | 30 |
| Total | 80.00% | 72.22% | 17.78% | 22.22% | 45.56% | 22.22% | 90 |

Next, we checked the percentage of advice considering the learner's information and the percentage of advice that is considered correct. The results are shown in Table 3. The results show that 72.22% (65/90) of the advice texts are considered to be appropriate for the goal setting and reflection. It was also found that 71.11% (64/90) of the advice texts are created in the flexible expression format with learners' intention, combining learners' goal setting/reflection with learning history. Furthermore, it is found that 97.78%(88/90) of the advices are considered appropriate expressions in the text. Finally, 70.00%(63/90) of the advice was a combination of learning history and goal setting/reflection, and there were no inappropriate expressions in the text.

Table 3. *Percentage of Advice Considering Learner Information and Not Inappropriate.*

| Consideration of learning history | Consideration of goals and reflections | Mixed advice | Not inappropriate advice | Mixed & not inappropriate advice |
|---|---|---|---|---|
| 98.89% | 72.22% | 71.11% | 97.78% | 70.00% |

※Mixed advice : Advice combining learning history and goals/reflection.

## 5. Conclusion and Future

In the proposed method, it was found that advice sentences can be generated considering the characteristics of the learner while also considering reflection and goal setting. It is considered that the proposed method can automatically generate advice sentences that are similar to those given by actual teachers. In the future, we plan to construct a learning support system incorporating automatic learning advising and evaluate its usefulness in actual classes. The research will be conducted in compliance with the regulation regarding personal information protection for LLM in our research institute, based on informed consent.

## References

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