

Investigation On Applying Psychology-Based Learning method in Distance Learning System

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Abstract

With the advantage of scientific and objective, many educational psychology-based learning methods are widely used in the school educations and individual studies. At the same time, recently the WWW based education systems are flourishing. But there are still few learning methods standing up for the WWW based learning, so the learning quality and efficiency can't be ensured. In this paper, we propose a method to apply an educational psychology-based learning-support method for individual learning in web-based distance learning system. This method is based on effective study method SQ3R, which is a very popular learning method in school educations.

Because the metaphor in school education is different from that in web-based distance learning, the effective study method SQ3R cannot be directly applied into the web-based distance learning system, so we design a method to support the learners using SQ3R in the web-based distance learning system. In this method, at first, the learning activities are divided into five stages, and a set of tools are implemented to support the learners at each stage. Then the learner's actions at each stage are caught. At last, according to the learner's understanding situation and the actions, the learner's weak-points are pointed out, and an navigation, which suggests the learner to a certain stage, is given.

Also, we have implemented the designed support method and tools in the web-based distance learning system that we have designed earlier, we have done an experiment, and the statistics analysis of the experiment showed that supported by this learning method and tools, the web-based system assists the learner to grasp the general image of the contents, helps the learner to perceive his/her position in the contents, reminds him/her to keep attention on the process of learning, helps the learner to keep his/her learning motivation.

Keyword: distance learning, web-based learning, educational psychology, study method, learning tools, learning motivation, learning efficiency, SQ3R.

1. Introduction

In recently years, computer and network have been rapidly developed. Particularly, the e-Japan strategy, which was brought up by Japan government, had been spreading computer and network into everyone's life, and making the lifelong learning to be a reality. Also the growing up new hardware technologies satisfy the user's needs more and more. And in the aspect of software, the web-based distance learning systems provide abundant, rich contents to suit learner's needs.

Furthermore, the development of IT had been changing the metaphor of school. From the viewpoint of the Internet, the education (including web-based distance education) should not be restricted in a certain place, and a designated time. Again, the web-based distance learning systems make it possible to completely use the existing educational resources, such as the teacher resources, and the classroom resources etc. And these sys-

tems broke the limit of time and space, they can give services to people at anytime and at anywhere. They bring lifelong education to everyone's home. Even for those students who refuse to go to school also can study via WWW with a comfortable and easygoing feeling. So, we can see that web-based distance learning, as a new media of learning, becomes more necessary and more important.

As we mentioned above, the web-based learning brings much benefit to everyone's lifelong learning instead of traditional school learning. But the traditional school education has strong background on the educational psychology theories, many effective study methods have been developed based on these theories, such as meaningful reception learning method, PQ4R learning method, SQ3R learning method etc.

The educational psychology regards human's learning mechanism as its theme, it scientifically analyses the recognition and memorizing algorithms. So it is scientific and objective. Many school educations and individual learning activities are using the educational psychology based learning methods. And by using these learning methods, it has been proved that the learning efficiency can be improved and the latent potential of learners can be explored.

On the other hand, the web-based learning is a new field, there are still not too many learning methods for it. So we mainly focus our research on how to utilize the existing effective educational psychology-based learning methods into web-based learning.

But, because the medium is different, the learning support methods and tools on the WWW should be different from that in traditional school. Here we give the comparison between learning through WWW and learning at traditional school in Table 1.

Considering these differences, the learning support methods and tools, which are used in traditional education, cannot be directly translated into the WWW based learning activities. So, how to conjugate the learning methods, which are used in the traditional education, into the WWW based learning becomes an urgent task.

In our research, we import an effective study method called SQ3R into the web-based distance learning system. We have discussed a method [3] to use the learning method SQ3R into web-based learning. Based on that method [3], in this paper, we give a further discussion about the design and implementation of the learning method SQ3R, then give an evaluation based on the experiment using SQ3R method in distance learning system.

2 Applying SQ3R to WWW based learning system

In this section, we give an introduction of learning method SQ3R, and describe how to apply SQ3R into WWW based learning.

2.1 Outline of SQ3R

SQ3R is an effective study method, which has been proved to be efficient in the traditional school education.

The effective study method SQ3R is developed based on learning experiences of lots of people and research results of educational psychology. More specifically, this study method is developed based on the mechanisms of memorizing, forgetting and cognitive processes of human's brain.

Table 1. Comparison of WWW based learning and traditional education

	Learning at traditional education	Learning through WWW
Course organization	Contents are given in systemic styles. It's always organized consistently, section by section in a sequential order.	Links among various kinds of related web-based knowledge pages can be made. In these related contents pages, enormous information and abundant knowledge can be obtained.
Background	Supported by experienced teachers, teaching and learning support methods based on educational psychology theory.	Supported with multimedia contents that is informal, Internet technology, and so on.
Location	School (university)	Anywhere
Times	Class time	Anytime
Duration	A certain period	Continuance
Contents	What have been prepared by teachers	Unlimited resource in internet can be used
Scope	Systematic study	Practicable study, applied study
Target user	Students, beginners	Beginners, professionals, experts

Here, we introduce SQ3R following [1][8][9][10][11][12][13]:

Survey In order to help a learner to get a whole view of one book or one chapter, psychologists advise learners to glance over the headings of each section, and the summary parts, to find the core idea of that parts in a few minutes.

Question In order to arouse learners' curiosity, and help them to understand the sections quickly, psychologists advise learners to ask questions, such as turning the first heading line into a question and so on, then try to find answers of these questions.

Read Read the section quickly, carefully, and try to find the answers of questions that have been asked at Question stage actively in a short time.

Recite After reading, try to repeat the sections. When you cannot continue, sweep over the section and recite, then continue with sweep over and recite, until to the end.

Review After a long time of learning, look over the headlines and notebooks to recall the knowledge that have been learned.

2.2 Policy for applying SQ3R to distance learning system

As above-mentioned, the SQ3R (Survey, Question, Read, Recite, Review) are different stages of learning activities, and there are inseparable

relations among these stages.

From the viewpoint of educational psychology, to let the learning activities be sustained, the learning motivation and learning efficiency are the most important factors. The motivation lets the learning continue, and the learning efficiency guarantees the learning result being kept. The study method SQ3R just satisfies the two points. In 1800's psychologist H.Ebbinghaus who did research on the memorizing algorithm found the save curve of memorizing, and got the conclusion that along with the time goes, the memorized contents are being forgotten. According to that research, psychologist Robinson found that to make up the deficiency of the forgetting, to let the learners review on time is the best way to keep the memory for a long time. Applying that research, he discovered the study method SQ3R.

The relations of SQ3R, memorizing knowledge, and functions of every SQ3R stage are shown in Figure 1.

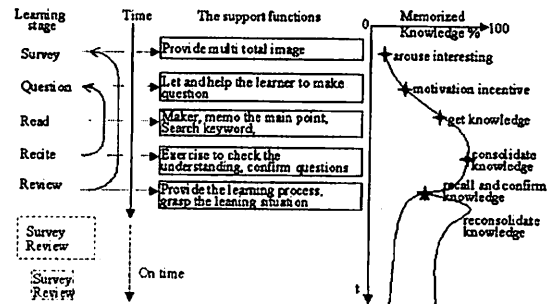


Figure 1. Relations of SQ3R, memorizing and functions of each SQ3R stage

From Figure 1, we also can see that the relation between stage survey and stage review, and the relation between stage recite and stage question can be shown as following:

1. Survey stage is related to Review stage. In Survey stage, a whole picture of a course and the highlights of each subsection are given, and these just the main points that should be checked at Review stage.
2. The Queries and questions, which are given or asked in Question stage, should be confirmed at Recite stage, to remind the learner to verify if these questions have been solved or not. So, Recite stage should echo back Question stage.

3 Design of SQ3R-based supporting method and tools

In this section, we present the construction of the SQ3R based support system, and then describe two main parts of the system.

3.1 Construction of SQ3R based learning support system

According to the above-mentioned SQ3R applying policy, the learning support system is designed as the following (refer to Figure 2):

This learning support system is composed of six parts.

1. Supporting mode control module:

In the distance learning support system, three kinds of supporting modes, which can be set by the system and the learners, are provided. The three modes are free mode, constrained mode, and on demand mode.

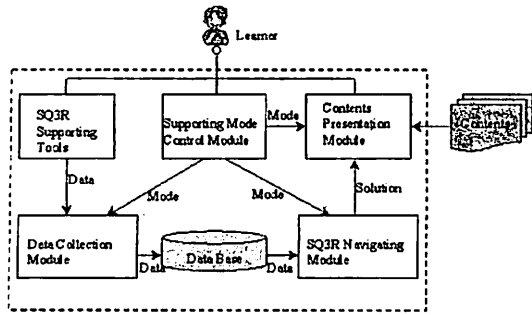


Figure 2. Construction of SQ3R based learning support system.

- Free mode means that the authority is given to learners. There is no SQ3R navigating function provided to the learner.
- Constrained mode denotes that the system provides contents and manages the learner's progress using the SQ3R navigating function forcibly.
- On demand mode is that the SQ3R navigating function will work for the learner, but it will not influence the learner forcibly. The navigating function only works when it is requested by the learner.

By checking the learner's understanding situation and completeness of contents, the system will change the SQ3R supporting mode for the learners dynamically. Also, the learners can select the supporting modes by themselves at the learning process.

- SQ3R supporting tools: According to the redefinitions and applying policy of SQ3R, and in order to fulfill requires of each stage, a group of tools are provided. The detail of them will be discussed later.
- Data collection module: In this module, the learner's learning actions at each SQ3R stage and the learner's learning completeness at every SQ3R stage are detected. Then, the detected data will be stored in the learner's database, and will be used for SQ3R stage navigation.
- Learner's database: This is a storehouse for the detected learner's data, and it's the basis of SQ3R navigating module.
- SQ3R navigating module: In this part, based on the detected learner's data and the learner's learning progress, the weak stage and the omitted stage of SQ3R are caught, then the best contents and the best stage of SQ3R for the learner are advised.
- SQ3R supporting contents presentation module: According to the solutions of the navigating module, the contents presentation module re-organizes the contents and the subset of SQ3R tools together, then presents them to the learner. For example, for a learner who has written some questions at the question stage, when he/she lefts for a new page of contents, if the solutions of the navigating module is to confirm if the question points have been understood or not, the contents presentation module will arrange to show the list of questions before starting a new contents page.

3.2 SQ3R based supporting tools

Summarizing the psychological theory and the applying policy of SQ3R, we give the necessary functions for every SQ3R stage, then a set of tools are furnished to realize these required functions. The design of tools for each SQ3R stage is shown in Figure 3:

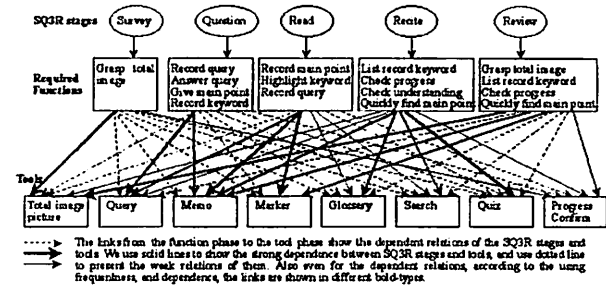


Figure 3. Structure of tools' design.

The basis of the tool's design procedure is that we analysis the goals of each stage at first, then the needs and the required functions are collected, at last, the tools to accomplish these needs and required functions are designed.

We give eight kinds of tools in the distance learning system, such as whole picture of contents, query tool, memo tool, marker tool, glossary tool, keyword searching tool, quiz tool, progress confirming tool and so on. The learner can select the tools to use at each stage.

3.3 SQ3R navigating algorithm

In the distance learning support system, we utilize rule-based inference to navigate learners the learning stages based on the detected learner's data. The detected learner's data consist of three types of actions:

- learner's trace information of using tools: not only the tools are designed for supporting the learners to study the contents, but also the learner's trace of using the tools at each SQ3R stage is an important data helping the system to grasp learner's learning activities, to assist the system to give an appropriate navigation to the learner. That trace information includes time-related information and count-related information.
- the learner's progress situation: such as learned or not learned information for one subsection, and the rates of correct answers for quizzes.
- the information of the learner's psychology status: it includes the learner's characteristic tendency, the learner's feeling etc. These information are caught by questionnaires embedded in quizzes.

In the distance learning support system, when a learner finishes a quiz, the accomplishment situations of the quiz are pointed out, at the same time, an interactive navigating window is given. Also, the learner can request a navigation on demand at any time.

To give a course navigation, the following items are checked.

- to check the learner's correct answer rate, the learner's right answer rates are divided into 5 levels.
- to check the learner's tools using information, in this step, the using frequency of query tool at question stage, the using frequency of memo and marker tools at read stage, the using frequency of search and glossary tools at recite stage are mainly checked.
- to check the learner's psychology status, the psychology status include learner's confidence and satisfaction for his/her answers.
- to check the learner's error pattern, according to the relations of contents, to find the learner's weak points and the related useful knowledge.

Based on the above checking results, a course navigation based on SQ3R is given. The navigation is presented by an advice or a hit.

The Figure 4 shows a part of the navigating algorithm by a tree.

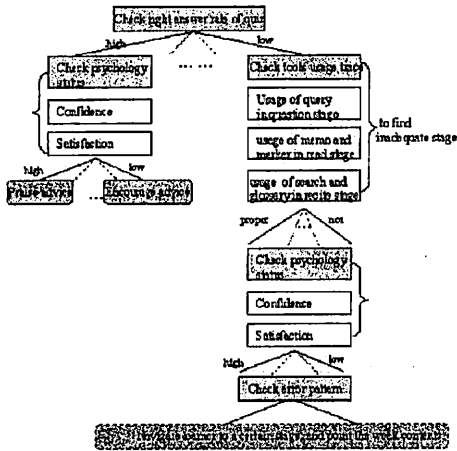


Figure 4. Part of decision tree for navigating.

In Figure 4, each leaf from the top root to each bottom ending is one rule for navigating. Samples of the rules can be shown as following:

- Rule 1: IF correct answer rate is very low and many questions and memos, but no question answering action
Then navigate the learner to go to question stage to answer the asked questions.
- Rule 2: IF correct answer rate is high and the learner is satisfied and confident
Then a inspiring message, and the next contents are given.

4 Implementation

The above-mentioned tools and SQ3R navigating function have been implemented in the distance learning system. Here, we introduce the details of the memo tool's implementing and the implementing of the whole picture of contents, and then the outline of the implementing of the other tools is introduced.

4.1 Implementation of the memo tool

The memo tool is mainly used at the stage of Question, Read, Recite, Review. The implementing structure of memo tool is outlined below (refer to Figure 5):

In Figure 5, the links between database and interface show the functions of memo tool. The functions such as memo recording, memo listing up, memo editing, bi-directional jumping between contents and memo list, and memo opening are provided.

When a memo is recorded, some additional information are recorded into database with the memo data. The additional information include pageID, lineID, memo's subject, and so on. So when a learner opens a page, which has a memo in it, a memo icon is shown at the beginning of the line where the memo is. Clicking on the memo icon, the subject of the memo will be shown in a popup window. Also, all memos can be shown together, and a memo have attributes. The attributes can be divided as warning, comment, individual note, question, etc. Using these attributes, the memos can be managed/accessed easily.

The meaning of public item in memo's structure is that if the value of public item is true, it said that the memo can be used by all user, if the value is false, the memo only can be used by the user. Using the memo opening

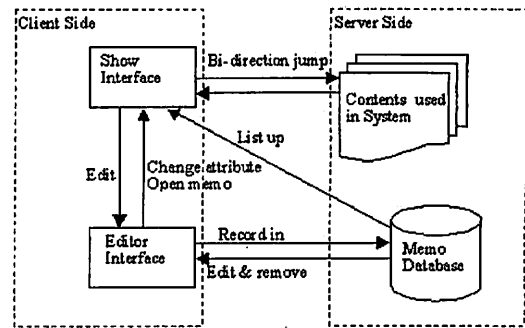


Figure 5. Structure of the memo tool.

method to public a memo, the memo recorded by a learner can be viewed by all learners. The public memos construct a shared knowledge square. The illustration of the memo's knowledge sharing is shown in Figure 6.

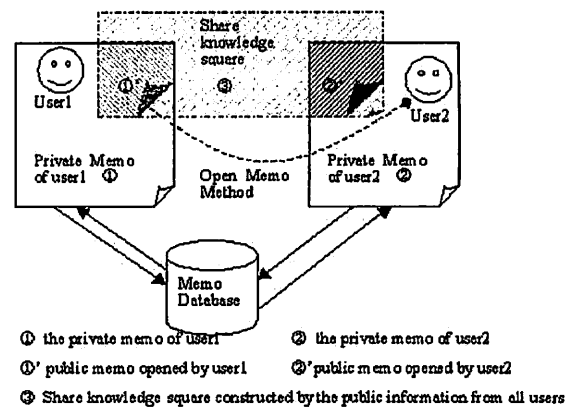


Figure 6. Illustration of the memo's knowledge sharing.

Just using memo's opening method, the shared knowledge domain among the learners will be built, and the knowledge and information sharing is achieved.

4.2 Implementation of whole picture of contents

We give two formats to present the whole picture of course contents. One is the text format, like an index of a book, the index items in the index page are hyper-linked to the contents pages. The other format is graphic format. It uses a contents map, which contains knowledge nodes and relation links. The knowledge nodes are pages of contents; The relation links are the relation information between each pair of knowledge nodes. The detail about the contents map is described in [?].

The constructure of contents map is designed as hierarchy, which is shown in Figure 7, the knowledge nodes in higher layers are more abstract, the knowledge nodes in lower layers are more particularly. Using the higher layer maps, the learner can get a zoomed out map of the contents. By clicking into the knowledge nodes in a high layer map, a zoomed in low layer map of contents, which contains the detail knowledge of one node in the high layer, is given.

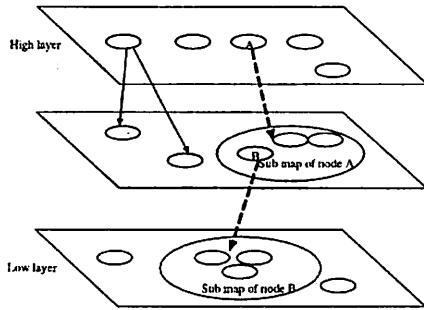


Figure 7. Diagram of hierarchy of contents map

The implemented whole picture of contents is shown in Figure 8.

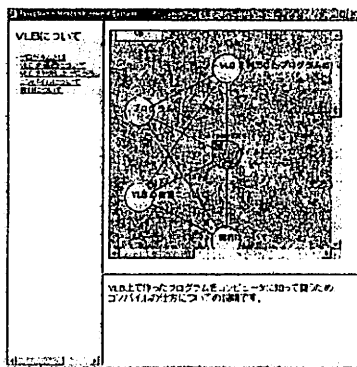


Figure 8. Image of whole picture.

4.3 Implementation of the other tools

The implementations of the other tools are concluded as following:

- Marker tool: Marker tool uses colors to help learners to highlight the special points and special lines in the course contents. The marked colors and positions can be changed and can be removed.



Figure 9. Image of marker.

- Glossary tool: In this system, a glossary gathers all useful keywords together, to help learners to quickly find a centralized illustration of every focal points. (refer to Figure 10).
- Search tool: A keyword search function among the course contents is given.
- Progress confirming tool: Because one of the good ways to keep the learner's learning motivation is to let the learner know the level and learning results, the system records the learner's learning situation for each part of contents, and these information can be presented to the learner at any time.

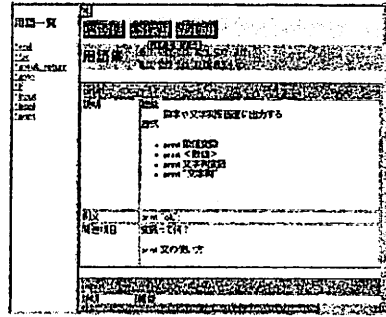


Figure 10. Image of glossary.

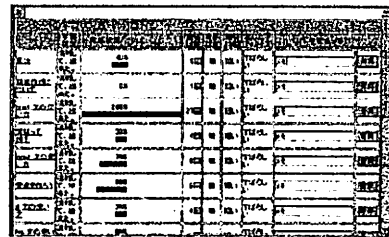


Figure 11. Image of progress.

- Quiz tool: The system provides two ways to help a learner to check the his/her learning situation, one is using blank-filling exercise to check the learner's understanding situation, and the other one is to use test to check the applying ability of the learner. At the time of exercise and test, the learner's response data is recorded as the original data of course navigation. Furthermore, the learner can consolidate the learned knowledge by doing quizzes.

5 Experiment and evaluation

5.1 Method of experiment

The experiment of the effective study method SQ3R based distance learning support system has been carried out. The contents is basic language, the learner are students in the University of Aizu. The learners were requested to learn the text contents free. In the text contents, there are explanations, samples, and tasks. A learner learns the text through web browser, tests the samples at the VLB¹ environment, then finishes the tasks. At the learning process, learner can utilize the tools at any time.

The experiment was arranged for two hours learning, after individual learning using the WWW-based learning system, a questionnaire sheet was answered.

5.2 Result of experiment

In the questionnaire, the frequency of using the supporting tools', the validity of tools, and convenience of the tool's usage are collected.

The result of the using frequency of the supporting tools is shown in Figure 12. As shown in the figure, the quiz tool, whole picture of contents,

¹VLB means Visual Legacy Basic, it is an visual basic language editing and compiling environment.

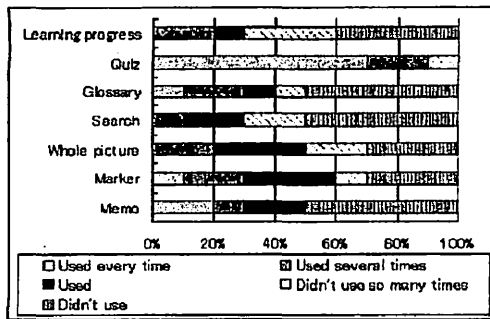


Figure 12. Diagram of the tool's usage result.

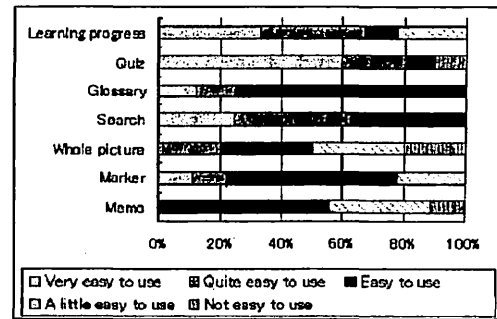


Figure 14. Diagram of the easy-use result.

marker tool, and memo tool are initiatively used by the majority of learners, especially, about 90% of learners used the quiz tool.

The tool's validity responses are shown in Figure 13. About over 80% of learners thought that the tools are valid to support the learner studying the contents.

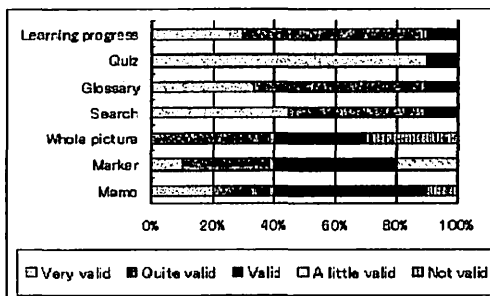


Figure 13. Diagram of the tool's valid result.

The tool's convenience of tool's using is statistised in the Figure 14. We can see that, over half of the learners satisfied with the convenience of tools.

And beside the aboved metioned results, we although got the following results from questionnaire:

- There are learning support tools to assist learner solving problems and to finding answers and hits, so the worries in the learning process have been dispelled, the learners can concerntrate on learning. Especially, the advices and paises in the learning process, improved the learner's confidnce and satisfaction.
- The learning progress confirming tool shows the learner's achievements and tasks, many learners said that in the learning progress, they can self-control the learning process with a clear direction.

On the other hand, some learners pointed out the shortcomings in our system, such as, the layer construction of whole picture of contents is not so clear, and the edit function of memo tool is not easy for using etc.

Also, many valuable and precious comments have been given by the learners, for example, when presenting the learner's progress, if the other learners' progress can be shown at the same time, the learner's competinion will be stimulated and the learner's learning motivation can be improved etc. These valuable comments and suggestions will be considered in the later version of the distance learning support system.

6 Conclusions

In this paper, we proposed a learning support method and developed a set of learning support tools based on the effective study method SQ3R, which is developed under the background of educational psychology. Also, the set of tools and a SQ3R-based course navigation function have been implemented in the web-based distance learning system. An experiment of the web-based system was given, and the validity and convenience of the system have been proved. In the near future, we will do further experiment, to get more detailed learner's data, and to verify the validity of the navigation method and tools. Also, analyzing and considering learner's psychological factors in more detailed level, and applying these psychological factors more flexibly are the tasks remained in the future.

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