

# Development of an Online Education System for Enhancement of Mentor-Based Self-Directed Learning

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## **Abstract**

*The purpose of this study is to design a learning supportive model of promoting interaction to enhance self-directed learning ability by utilizing a mentor in an online learning environment, as a learning method to overcome the regional gap and economic gap between mountain and fishing villages and cities. The problem of learning carried out in the online environment is that the self-directed learning ability is absolutely required in terms of the environment where learners' empowerment is maximized because it is hard for a proper interaction to happen between students and instructors. In this study, in order to improve the self-directed learning ability of learners, according to the procedural model system designed based on the self-directed learning model, mentors continuously interact with learners by utilizing digital media such as phone and tablet. According to the analysis result, they put self-regulated elements which yield a result that increase academic achievement of e-learning learners. Based on this result, we aim to design a remote mentor program for mentors to effectively bring self-control learning factors to learners and to support education for the learners. In this paper, the framework of long-distance learning supportive model is described and the function that the mentors monitor the learners and bring self-control learning factors to the learners is described. Education practice and evaluation result using this function is described and through the model, learners' self-control learning ability is shown to improve.*

**Keywords:** *Self-regulated learning, Self-directed learning, Long-Distance Education System, Mentor, Rural communities*

## **1. Introduction**

In accordance with the rapid development and distribution of web and network technology, E-learning environment has been variously developed. Accordingly, the various learning styles tools and applications to support learners are getting required, thus a number of tools which can be used for E-learning environment have been studied and developed[1]. In this environment, we should explore the next generation learning model in the intellectual society. At the same time, in the e-learning environment it is desirable to solve the challenge for new e-Pedagogy of learning and education[2].

The reason to pay attention to E-learning education in this study is that it can overcome the limitations such as cost, region, distance and space-time, which is the benefit of the e-learning education.

In Korea, the education gap between regions (especially between cities and rural areas) and the gap between the classes are engaged, which worsens the phenomenon. The most outstanding educational gap through educational alienation is the gap of educational background between cities and rural areas. The problem is that the alternatives of the proper teaching method lack to overcome the regional gap and the economical gap.

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Although there were various social and technological attempts in the past, these regional and economic gaps have not been solved practically due to physical conditions (cost, manpower, educational infrastructure, etc.). E-learning in the 2000s has made sudden rise as an alternative educational method to the knowledge information society that can solve these problems, which has attracted attention [3].

By using the advantages of the e-learning education, it is possible to resolve the educational imbalance and the educational gaps, and it will play a role of catalysts to resolve the educational gaps, currently the disease in Korea. However, in order to overcome the decrease of educational effect due to the lack of interaction, the weakness of the e-learning education, a problem that learners' self-directed learning ability must be supported exists.

The e-learning in terms of the environment where learners' empowerment is maximized, can be said to be a situation that requires the self-regulated learning ability of the learners to plan and conduct their own learning for themselves than a face-to-face learning situation. However, the current situation of cyber education in schools and corporations shows that the learners are having a hard time to continue their self-learning and ultimately high dropout rates. These phenomena, indicate there are problems for many learners to carry out their independent self-directed learning in the e-learning environment.

As an alternative to solve these, it is required to develop an e-learning model that learners can have their self-regulated learning ability and though this, the self-directed learning is possible. A remote learning supportive model that interaction is possible, including roles and ways of coordination and acceleration, is studied for these requests.

When we look at the current studies, there are customized learning through learning patterns, learning by level for complete learning, development of questions based on Bayesian inference and intelligent teaching and learning of learner module.

Most of the existing researches with the given evaluation problems, suggest solutions focused on mainly evaluation questions such as analyzing learners' patterns or supporting learning by levels. This implies a problem that there is no practical interaction in the learning process at the level that supports the acceleration by adjusting the level of questions and presenting easy questions through analysis of the questions.

In this study, practical interaction in the learning process can be provided by putting a teaching assistant, the so-called mentor, and providing a training process which will improve the learners' self-directed learning ability. Through this system, the learners can have their own self-directed learning ability for themselves.

Considering the background of this study, the goal of this study is to create the activities in a mentor learning supportive environment wherein even with no motivation, group learners will work on studying problems and instructors providing classes in schools, and in this model, to develop mentors' learning supportive method and several tools [4]. In addition, we aim to design a mentor-based program to provide a remote learning supportive ability.

For the development of the educational system which meets these needs, in this study, the remote educational system for mentor-based self-directed learning ability enhancement that supports self-directed learning by artificially intervening self-regulated learning factors is developed in an interactive process by utilizing mentor.

This paper first explains the theoretical background on the self-regulated learning and the self-directed learning, the framework of the remote learning supportive model, a way for a mentor to monitor a learner, a way to intervene in the self-regulated learning factors and the function to activate mutual communication. It also explains on the educational training process using this function and the evaluation results with improved academic achievement.

## 2. Theoretical Background

### 2.1. SRL(Self-Regulated Learning) Model

A study on self-regulated learning has been driven by studies on self-control or self-regulation of human beings, and after the 1980s, Zimmerman, B. J. and his colleagues have actively conducted the study. The full-scaled study can be said to have been started by researchers with Zimmerman in the center, as the social cognitive theory of motivation emerged as a rapid rise, studies on self-efficacy, attribution, and expectation appeared, and the research on self-control was started. After that, it has been studied in various theoretical perspectives such as activism perspective, phenomenological perspective, social cognitive perspective, will perspective, Vygotsky perspective, and constructive perspective [5].

Corno found that the self-regulated learning is that learners themselves form learning context into deepening cognitive network structures and furthermore the learners check and improve the deepening process, and Schunk pointed out that the self-regulated learning includes attending to and concentrating on classes, organization and coding of memorized information, demonstration, making of productive learning environment, effective utilization of sources, individual ability, learning importance, factors affecting on learning, expectation and results of action, satisfactory of individual effort and experience of self-confidence [6, 7]. Zimmerman defined that, when a child is studying, the active learning that the child meta-cognitively, behaviorally, with motivation participates in, is the self-regulated learning. Zimmerman pointed out personal process, environment, and behavior as three determining factors that control learning. In addition, he also pointed out that strategies can make learners to control their behavior, environment and their hidden functions. The learners can reach a learning goal through strategies such as goal setting, planning, demonstration, memorization, organizing, transformation, and personal behavior through self-confidence, sense of achievement, self-motivation, and the efforts to study in their environment or to improve the environment into a good condition to study, and collection of learning materials.

Pintrich and De Groot defined a meta-cognitive ability to manage and control a cognitive ability that learners perceive the given learning materials given to them, structure it, store in long-term memory and withdraw it when needed, and recognition as the self-regulated learning, and mentioned that the self-regulated learning includes the learners plan, control, cognitive modification, management and control of effort on learning tasks, and cognitive strategies that the learners use to learn, remember and understand[8].

The self-regulated learning includes meta-cognition, motivation, and behavioral factors. In other words, the self-regulated learning means that, when conducting learning activity, the learners actively participate in the learning process in terms of meta-cognition, motivation, and behavior and the self-regulated function is the practical psychological mechanism to enhance scholastic achievements. Here, participating in learning by using meta-cognition means that learners plan learning, set a goal and conduct self-monitoring and self-evaluation during the learning process. And through this process, learners perceive their learning and gain insight and confidence in their own learning. In addition, from the motivational level, a self-regulated learner has high self-efficacy, does self-attribution and approach with intrinsic interest. Furthermore, participating actively in learning in the level of behavior is that self-regulated learners select and construct the best environment to achieve their educational goals, find the best place to study and do self-instruction and self-reinforcement during the learning process. In short, as Zimmerman pointed out, self-regulated learners systematically use a meta-cognitive strategy, a motivation strategy, and a learning strategy to improve their scholastic achievements.

## 2.2. Self-directed Learning Model

An interest of self-directed learning has already been mentioned in Dewey's progressive educational philosophy and in humanism.

However, the most direct opportunity was started when Houle, a professor in Chicago University published a book, 'The inquiring Mind', for adult education in the early of the 1960s, and his pupil, Tough from Canada formed a theory and Knowles hardened the serious foundation. The concept of the self-directed learning is defined variously according to researchers. For example, Corno & Mandinach defined it as 'learner's intentional efforts to be the main force of learning' [9], and Long defined it as an accompanying process with a cognitive action to reveal and look for the necessary information as purposive and intellectual process, personally driven [10]. Among these definitions, the most frequently quoted definition is the Knowles' definition. He defined the self-directed learning as 'a process and activity that an individual learner finds out his/her learning needs, sets learning goals, secures human and material resources necessary for learning, selects and execute appropriate learning strategies, and evaluate his/her own achieved learning results, with initiative in learning, regardless of whether or not the learner has help from others. In short, the self-directed learning is a process where learners plan, execute and evaluate their entire learning process with their initiative

In the self-directed learning model, there are Knowles and Tough's linear model, Spear and Mocker's self-directed learning process model, Grow's self-directed learning phase model, Garrison's integrated model of self-directed learning emphasizing learners' variables [11, 12, 13, 14]. Knowles suggests a model of a linear process that is logically proceeded, based his own definition of self-directed learning. This model consists of 5 phases, 'learning needs diagnosis → setting learning goals → identifying human and material resources for learning → selecting appropriate learning strategies → evaluating the achieved learning results.

The characteristic of Grow's self-directed learning phase model is that self-directedness makes progress over phases. Learners divide the self-directedness into 4 stages and set the role of an instructor differently in accordance with each stage. In other words, it begins with a lecture (step 1) and steadily takes steps to be self-initiated as constructed discussion-oriented (step 2), less constructed discussion (step 3) and lastly, self-initiated discussion and task resolution (step 4). In this model, the role of teachers changes as experts → guides → facilitators → advisors. This step model has been explained by stages, but practically it is non-linear and repetitive, depending on the nature and circumstances of the task. For example, in step 3, if it is determined that lecture is necessary, it can go back to step 1 temporarily and come back.

Garrison's integrated model is a model emphasizing learners' factors in learning, that is mutually connected with self-management (control of tasks), self-monitoring (cognitive responsibility) and learning motivation (participation motivation, task motivation). The self-monitoring is to set and manage learning goals, select learning method, manage learning resources, and consider learning results. Instructors help learners with self-monitoring. The self-monitoring is a cognitive and meta-cognitive process. It is a process to plan and modify thinking according to learning strategy, learning task, and its purpose. Lastly, motivation plays a very important role in maintaining participation and effort on learning and achieving its goals. In here, while participation motivation directly influences on the efforts invested in learning tasks, task motivation focuses on learning activities and the continuity of a purpose.

### 3. Mentor-based Remote Learning Supportive Model

The existing e-learning educational system is a system to support final feedback through evaluation results. This is actually hard to find out in which process a problem occurs for learners. Therefore, an actual mentor intervenes in the learning process, and gives feedback on the learner by substituting SRL factors. Through this, the learner can enforce the self-directed learning ability.

In order to judge the learning effect, learning evaluation is important. However, in the case of young learners (particularly elementary students), it is incomplete and hard to judge their learning ability with the learning results in online learning environment. It would be rather important to judge whether or not learners have positive attitude to conduct self-directed learning, and help them have this self-directed learning ability.

Based on the SRL theory of Zimmerman, this study assumes that, if each factor is enhanced for learners, the learners' self-directed learning ability will also be enhanced. For intervention of these regulatory factors, LMS system is constructed for mentors to add intervention elements in online learning. By extracting these SRL elements to insert as SRL coding and applying it into the system and it has constructed the SRL elements to strengthen the SRL ability in the process that mentors monitor learners. In online learning environment, the system has been designed to extract SRL code analysis through LMS, for mentors to judge the current situation of learners and for intervention to happen on this.

The materials extracted by integrating mentor analysis with analysis results of LMS learning data through the input of the SRL code into the current LMS system, are used as mentors' feedback materials.

#### 3.1. SRL Element Extraction Coding

In this study, software elements which are necessary elements for diagnosis through interaction between mentors and learners are the SRL intervention elements. Here, it shows how SRL intervention elements are constructed. A researcher has developed the coding system for himself/herself by analyzing the affective characteristic of self-regulated learning strategies of the preceding research, and the final system through experts' evaluation.

SRL intervention factor codes for diagnosis and prescription of Table 1 were utilized for categorization to use learner management log as qualitative data. In order to facilitate and standardize the interaction between mentors and learners, interaction message analysis tools were used. Interaction between mentors and learners are done through conversations and since it is not good enough to express with just few words, this study utilized self-regulated learning measurement tools of Yang Myeonghee [15] and extracting features as base data of diagnosis and prescription which systematized them as reference elements of diagnosis and prescription. The SRL intervention codes were coded with the following roles:

First, Cognitive Strategy Activity is written as 'CA', demonstration, a sub-element of cognitive strategy category is written as 'CA1', elaboration is written as 'CA2', and organization is written as 'CA3'.

**Table 1. SRL Coding System**

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1. Cognitive Strategy Activity : CA
CA1 Use a demonstration strategy.
CA2 Use an elaboration strategy.
CA3 Use an organization strategy.
2. Metacognitive Strategy Activity : MCA
MCA1 Use the planning strategy to perform problem solving and decide whether to

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	use what strategies and information processing.
MCA2	Use the monitoring strategy to check the task performance and the degree of understanding of the relevance between information.
MCA3	By the monitoring results, check one's cognitive activity and adjust take performance.
3. Motivated Strategy Activity : MA	
MA1	Use a proficiency-oriented strategy.
MA2	Use a self-efficacy strategy.
MA3	Use an achievement value strategy.
4. Behavior Strategies Activity : BA	
BC1	Once a goal is set, use an action-oriented strategy to solve it out.
AR1	Use a social environment strategy actively which helps learning by voluntary needs of learners.
AR2	Use a physical environment strategy actively to focus on learning.
TM1	Use a learning time management strategy using time and sources for one's own learning and performance.

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Second, metacognitive strategy activity is written as 'MCA', abbreviation of metacognitive strategy activity, planning, a sub-element of metacognitive strategy category is written as 'MCA1', monitoring is written as 'MCA2', and adjustment is written as 'MCA3'.

Third, motivated strategy activity is written as 'MA', abbreviation of motivated strategy activity, proficiency-oriented feature, a sub-element of metacognitive strategy category is written as 'MA1', self-efficacy is written as 'MA2', and achievement value is written as 'MA3'.

Fourth, since behavior strategy activity has sub-elements of behavior strategy activity divided into behavior control, assistance request, and learning time management, the behavior control (behavior-oriented) is written as 'BC1', abbreviation of behavior control', the assistance request is written as 'AR', and social environment, a sub-element is written as 'AR1', physical environment is written as 'AR2'. Time Management is written as 'TM1', abbreviation of Time Management. It is an advantage that mentors can efficiently operate SRL intervention factors in the system and analyze the intervened factors through coding. Table 1 shows the definition of three strategies of self-regulated learning, in short, self-regulated strategy, motivation-regulated strategy, and behavior-regulated strategy after coding them.

### 3.2. Mentor-based Distance Learning Supporting Model

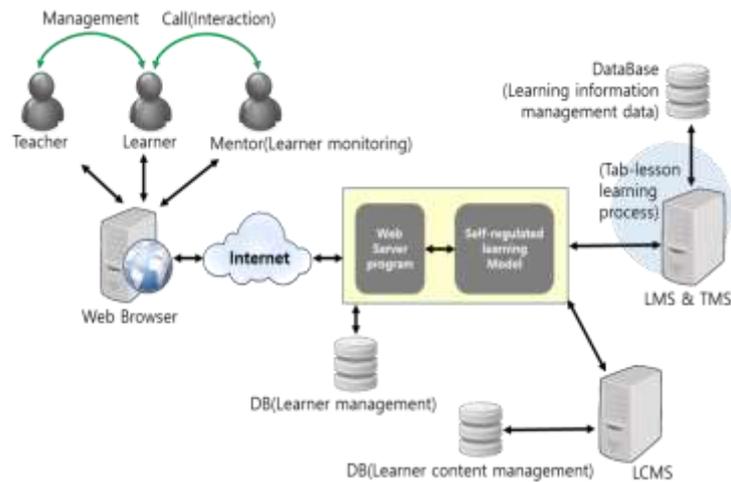
In elementary and secondary education, one of the key points for success in a mentor-based learning is the teacher's support for a learner's positive learning activities. However, in rural communities, it is difficult for one teacher to support the learners in various grades. In this situation, the use of e learning contents can help various graded learners as a complementary learning. However, young learners are so hard to regulate since they lack the self-control ability [16, 17].

Therefore, a mentor supporting environment is needed, in which it is possible to monitor the learning process and assist learning. Also, there is a lack of care for the students in rural communities. Care is the key element for young learners to learn. For the purpose of solving the problems, a learning model was designed, in which a mentor not only assists learning but also carries out caring the learners at the same time [18, 19].

In order to create a framework to solve this problem, a model was designed in which university students take part in problem-solving as a mentor. One mentor plays a role as an assistant who monitors 10 students at least, offering learning assistance with interactive communication. Figure I shows a Distance Learning Support Model for learning based on

a mentor. The purpose and definition of the model are as follows. A learner is referred as an elementary student in a rural community. A teacher serves as a manager to manage students in an elementary school. A mentor is the one who manages learning process and carries out TAS(Teaching Care Assistance) at the same time.

The purposes of this model for learners are as follows:First, help the learners improve their self-initiative learning abilities. Second, assist teachers in class. Third, care for students through after- school activities support. Fourth, support the distance learning environment to improve learning support ability of TCA.



**Figure 1. E-learning System Configuration Diagram**

In this study, LMS and LCMS were applied in order to carry out learners' efficient learning in an elementary school in rural communities.

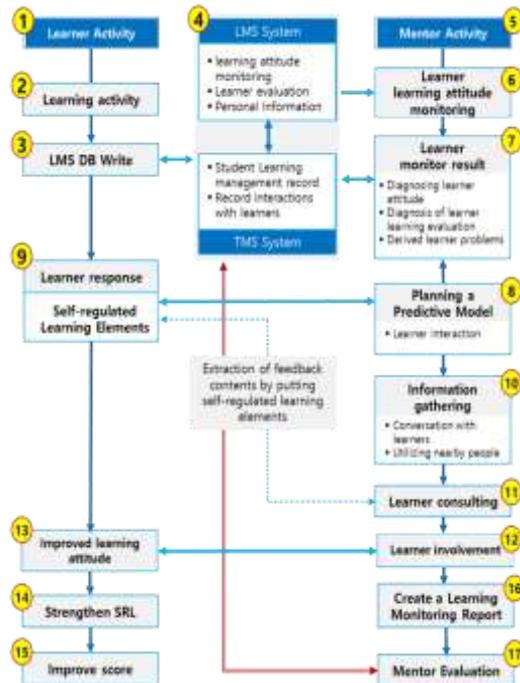
A learning model was configured in the process of learning on-line using Tablet PC, in which a mentor took part as a distance learning manager. TMS(Teaching Management System) was implemented in LMS system so that it will be convenient to support a mentor and manage learners Figure 1. TMS system's roles are as follows.

First, monitor learner's situation. Second, input the analysis results in DB. Third, monitor and record mentor's work process. Figure 2 shows how a mentor-based distance learning support model works as a learner and a mentor according to the step-by-step procedure. A mentor applies SRL(Self-regulated Learning) strategy which is able to analyse the current situation and solve the problem after consulting a student. SRL strategy is composed of 4 elements, which include cognitive regulation, meta-cognitive regulation, motivational regulation and behaviour regulation [11, 13, 18]. The procedures of mentor-based distance learning support model are classified as follows Figure 2.

### 3.2.1. Learning Monitoring & Diagnosing, Forecasting

Students carry out e-learning called 'EBS Edumore Tabgang' using tablet pc. Figure 2 shows as follows.

- ① A student starts the first learning step.
- ② A student carries out learning activities.
- ③ The history of learning activities are recorded in LMS DB.
- ④ Learning Attitude and assessment scores are recorded in LMS.
- ⑤ A mentor monitors the learning results in the LMS system.
- ⑥ A mentor inputs the problems which are analysed
- ⑦ through learning attitude diagnosing and learning evaluation based on the monitoring the results.



**Figure 2. Mentor-Based Remote Learning Support Model**

### 3.2.2. Interaction with a Learner

⑧ A mentor forecasts the current situation through telephone or video telephony, and ⑨analyses the details of response. Then, a mentor asks questions needed for establishing SRL strategy, which is able to solve the anticipated questions.

### 3.2.3. SRL Involvement

⑩ A mentor gathers information available in the neighborhood, in order to comprehend the learner exactly, for example, gathers additional information from teachers, parents, and friends.

⑪ A mentor carries out feedback process for the learner with an element among SRL strategies based on the learner's learning results.

⑫ A mentor carries out the procedures from ⑧ to ⑪, when is necessary.

### 3.4. Evaluation and Reinforcement

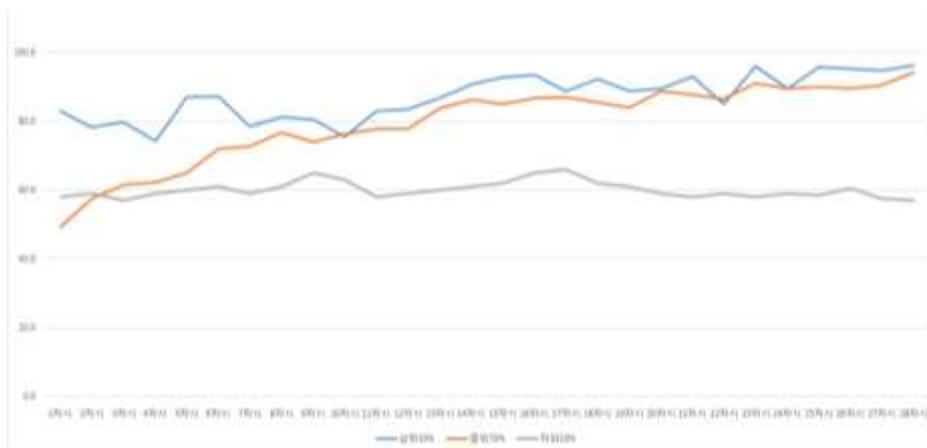
The results are as follows. ⑬ Learning attitude was improved, ⑭ learner's SRL ability was strengthened and learner has improved grade due to feedback from a mentor.

⑯A mentor input the analysis data derived from ⑧ to ⑪, ⑰analysed the input details and evaluated a mentor's activities.

## 4. Application and Analysis

This study conducted feedback on 457 elementary students with 10 mentors for 6 months. A mentor monitored and interviewed 10 to 15 students a day. A student communicated with a mentor over telephone 2 to 3 times per week. A mentor supported the students when it was needed, in spite of not teaching the student directly. Students learned through 'EBS Edumore Tapgang' every day. When the learning process was finished, evaluation was carried out. A teacher served as a manager of any activities in school. In the case of a school event or poor learning activities, teachers and a mentor

adjusted the learning schedule in advance. For the sake of reliability, learning tests were conducted 28 times. Figure 3 shows the results after the 28th learning activities. There was an overall learning improvement, though there was a case that learner had little learning benefit due to learner's characteristics. According to the results, it is suggested that interaction with a mentor has effect on learning and makes it possible for students to have self-directed learning, not to have dependent learning with a tutor. These results have such implication that e-learning can be a solution to solving the problems.



**Figure 3. Average of Learners' Academic Achievement**

## 5. Conclusion

This paper explained the purpose and method of long-distance learning supportive model, designing a model based self-directed learning theory and using mentors. Also, in order to activate this e-learning education, it explained strategies to put SRL elements.

This remote supportive learning model proposed in this study does not only make learners to learn, but also mentors play a role caring the learners instead of parents and teachers as well. The reason that the existing e-learning contents could not impact young students such as elementary students is that young students lack SRL ability. In order to solve this problem, mentors analyze learners' learning status, learners' learning evaluation score, learners' current psychological and environmental status, and informed appropriate SRL elements as feedback. In short, this study is a remote learning supportive method considering interaction with learners first prior to learning. Through this study, 457 learners of a population took 28 tests, and as a result, it was found out that most of the average score of entire learners increased.

When putting the self-regulated learning elements under the exact analysis according to the procedural stages of the self-directed learning model, learners' self-regulated learning ability is strengthened and because of this, it was found out that the academic achievement is improved through this study result, and it shows the effect of the developed system.

We will organize information related to mentor activation in the future. In addition, we will clearly analyze the meaning and associative relation by analyzing the big data of LMS and TMS systems, how the SRL strategy applied to learners had an effect on the SRL ability of the learners through what kind of interaction in detail.

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