The development of CERDAS learning strategy guide for science education students of distance education

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Abstract. Self-regulated learning (SRL) is a part of students' skills in which they manage, regulate, and monitor their learning process so they can reach their study goal. Students of distance education should comprise this skill. The aim of this research is to describe the development of distance students learning guide, namely "CEDAS strategy" designed for science students. The students' guidance consists of seven principles, they are; selecting and applying learning strategy appropriately, managing time effectively, planning of learning realistically and accurately, achieving study goal, and doing self-evaluation continuously. The research method was qualitative descriptive. The research involved the students of Universitas Terbuka' Biology education who participated in Animal Embryology course. The data were collected using a questionnaire and interview. Furthermore, it was analyzed by descriptive analyses. Research finding showed that during try out, most of the students stated that the learning guide was easy to understand, concise, interesting and encouraging for students to continue reading and learning. In the implementation stage, most students commented that the guide is easy to understand, long enough, and helpful so it can be used as a reference to study independently and to apply it in the daily basis.

1. Introduction

Self-regulated learning (SRL) refers to the thoughts, feelings and actions planned and systematically adjusted according to the needs that affect learning and motivation of a person [1]. SRL is a process involving students in regulating, managing, and monitoring complex learning process so they can achieve their academic goal [2]. SRL consists of processes such as setting goals for learning, attending and concentrating on instruction, using effective strategy to organize, making code and rehearsing information to remember, establishing a productive work environment, using resource effectively, monitoring performance, managing time effectively, seeking help when needed, holding positive beliefs about one's capabilities, holding the value of learning, including the factors affecting learning, anticipating outcomes of action, and resulting satisfaction and pride of the effort that has been done [1]. The self-regulatory process is a cyclical form which consists of three phases; they are, forethought phase, performance or volitional control phase, and self-reflection phase. Forethought phase precedes an actual performance and refers to a process which sets the stage for action. Performance control phase includes the processes that occur during learning and affect attention and action. Self-reflection phase, which occurs after the performance, is used when people respond to their efforts [3].

During forethought phase, high independence learners are going to achieve their learning goal and strategy planning. This phase consists of task analysis and self-motivation. Task analysis includes goal setting and strategy planning. Goal setting is an activity to determine the learning objectives and if necessary to modify them. In reaching his goal, a student determines an appropriate plan of learning strategies. Strategic planning is a strategy that will be used to achieve academic goals such as determining the use of cognitive strategies to achieve academic goals. A student can modify his learning goal or change his learning strategy if he knows that his goal cannot be achieved or his strategy is not accurate. During the performance phase, students use self-control strategies [3]. Self-reflection is the third phase. In this phase, students do self-judgment and self-evaluation. Self-judgments mean that students compare the current level of performance with their purpose. During the self-evaluation, students compare the performance with specific standards [4].

The ability of students' SRL can be improved through systematic interventions [1]. Students' SRL can be developed through the improving of time management skills, understanding and summarizing the text, noting, anticipating and writing the test [5]; through the development of cognitive strategies such as learning strategies that are specific to the content; and through the development metacognitive strategies such as monitoring and self-reflection.

SRL Skill of Open Distance Learning' (ODL) students are a must because of the character of distance education; a separation between teachers and learners. The level of SRL skill of ODL students should be well built due to a lack of interaction between teachers and students. However, SRL of ODL students is not as high as supposed to be.

ODL is a learning form of andragogy, in which learning process is designed to address the particular needs of adults [6]. Therefore, the following matters should be considered in ODL such as adult limitation, learning styles, previous learning experience, linkage of what is being studied and its application in life, linkages of previous knowledge with new experience, involving actively in the learning process, a need to provide a process of self-reflection in the learning process and support to make improvements in a variety of situations. So, ODL institution should appreciate to this situation and provide a learning guide for its students, especially for science students. Learning guide is needed for ODL science students to handle learning problems they are facing, so they can successful in their study. Furthermore, in order to improve SRL skills of ODL science students, in this paper, I d' like to describe how to develop a distance student learning strategy guide, namely "CERDAS" designed for science students. It will describe techniques of learning strategy that can be used to improve SRL skills of ODL students especially Science ODL students.

2. Research methodology

The research method was qualitative descriptive. The research consisted of some steps. The first step was the development of the draft guidelines. The second step was trying out the readability and the usefulness of CERDAS learning strategy (CLS) for Biology Education students - Regional Offices of Bogor and Surabaya (n=10) and then it was validated by experts (n=5). The third step was its revision based on experts' and students' comments. The fourth step was used by students who joined online tutorial in Animal Embryology (n=30) course. Data was collected using a questionnaire and interview. Then all of the data were analyzed in descriptive analyses.

3. Result and discussion

3.1. The development of the CERDAS learning strategy (CLS)

SRL of ODL science students guide in this research is a modification of CLS developed by Darmayanti [7] and Puspitasari [8]. The Darmayanti's CLS [7] was chosen to be the basic draft of learning guide for science ODL of this research because her intervention had a positive impact on student self-directed learning at Universitas Terbuka, especially on the component of students' learning needs [7]. The Darmayanti's CLS version describes tips or strategies on how to select and use learning strategies, manage and motivate learning appropriately (C); to use study time effectively

(E); to plan learning realistically (R); to set goals that can be achieved (D); to plan learning accurately (A); and to plan specific learning objectives (S). Initially, the material of Darmayanti' CLS version [7] is a modification of SMART learning strategy developed by Andersen [9]. SMART learning strategy refers to the ability to determine the purpose of studying specifically (Specific), measurably (Measurable), can be achieved (Attainable), realistically (Realistic), and time management properly (Timely). In this study, Darmayanti' CLS version modified researcher by adding and replacing the old material with the new and relevant content or materials, images, and illustration as presented in Table 1.

Table 1. The modification of Darmayanti' CLS Version

Section of Darmayanti CLS	CERDAS for science ODL students
What do you know?	Modifying illustration with the relevant illustration.
What is cerdas strategy?	Addition of self-evaluation concept because this concept is a part of self-reflection that supposed to be there
The letter C for Cerdik (Smart)	Changing the title and content on being smart in selecting and using learning strategy. Addition of scientific learning techniques: The technique of Preview-Question-Read-Reflect-Recall [10] Tips for reading scientific materials [11] How to arrange mind mapping [12]
Smart in learning management	Changing and adjusting illustration and content with the relevant illustration and content.
Smart in recognizing surrounding environment	Changing the title and content to a recent situation.
The letter E for Effective	Changing and adjusting illustration with the interesting illustration.
The letter R for realistic	Changing and adjusting illustration with the interesting illustration.
The letter D for goal attainable	Changing and adjusting illustration with the relevant illustration.
The letter A for Accuracy	Changing and adjusting illustration with the relevant illustration.
The letter S for specific	Changing and adjusting illustration with the relevant illustration
Example implementation of CLS	Simplifying examples; adjusting example of learning through online tutorials because the examples did not connect with the online tutorial; Addition of sample form used in selecting and determining learning techniques; Addition of mind-mapping, writing questions and answer, monitoring of learning targets and mastery of concepts in student sheet, because there was not practiced how to implement learning techniques /strategy
Closing notes	Modifying closing notes to adjust to a recent situation

Furthermore, the CLS for science ODL students was also modified from the CLS of Puspitasari [8] especially at the part of the example implementation of CLS. In this research, we modifying the table of target and learning schedule weekly by adding media column.

The strategies explained in CLS guide actually referred to aspects or dimension of SRL [1]. To be a self-regulated learner, a student has to have skills in setting goals of learning, using effective strategy, establishing a productive work environment, using resource effectively, monitoring performance,

managing time effectively, seeking help when needed, holding high motivation, and evaluating success or failure regularly. Therefore, these aspects are described in accordance with the condition as ODL Science students.

3.2. Step 2: Try out

Concerning the readability of the draft CLS guide for science ODL, through a questionnaire, 81.7 % students agreed that the draft CLS for Science ODL students was easy to understand. It was emphasized by the student during the interview. "The learning strategy is easy to understand, and its words are not so hard to digest." On the other hand, there was a student who commented differently. "The sentence was a bit difficult to understand. However, the illustrations can help me to understand the material". This comment shows that not all students understand the content of CLS guide for science ODL students. Therefore, CLS for science ODL students needed elaboration.

Besides that, 83.3 % students stated that the sentences that were used in the draft learning strategy guide were concise. It was supported by the result of the interview. "The learning guide is concise enough." However, there was a student commented in contrast, that the sentences used in the part of C for cerdik were so long, not concise. This comment shows that not all students agreed that the sentences that use in the CLS guide were concise. Therefore, it needed a little revision.

Relating to the illustration that presented at CLS guide for science ODL students, 95.8% students stated that the draft of learning guide had interesting illustration. Even, the students said that they could understand the material by looking at the illustrations presented in the guide. This comment shows that most of the students agreed that the draft of CLS for science ODL students had good and interesting illustrations. Therefore, it needed a very little revision. In addition to the usefulness of the draft of CLS guide for science ODL, 100 % students agreed that the draft of learning guide encourages students to learn other section of the CLS guide. Then, 100% students agreed that the draft CLS guide useful for studying independently. One of them said that CLS helped students, particularly for freshmen students who did not fully understand about independent learning or ODL. Puspitasari [8] also found that CLS that she used in her research are readable and useful, even though it needed revision and elaboration.

3.3. Step 3: Revision

In accordance with students, experts' comments and inputs, researcher then made revisions. After revisions, CERDAS Strategy guide was printed and stored in the form of word files. Then two forms of CERDAS strategy guide were printed in digital forms and delivered to students who were actively participating in the online tutorial course of Animal Embryology.

3.4. Step 4: Implementation

The sections of CERDAS learning strategy that integrated with the online tutorial as an exercise or training for improving students' regulating learning were some tasks that had to be done at week 1, 2, 4, 6, and 8 through the online tutorial. The tasks included arranging learning planning and its monitoring. Through this task, students had to arrange the schedule of learning for a week and to monitor if it was either achieved or not; Developing mind mapping of a relevant topic. In this task, for example, students had to develop mind mapping about the mechanism of division and blastula stage on Amphioxus and Amphibia; Compiling questions and answers. Through this task, for example, students had to arrange a set of essay test about the mechanism of division and blastula stage on Amphioxus and Amphibia; Doing self-reflection related to mastery of concepts. Through this task, students had to do self-reflection, asked themselves whether the topics had already been mastered or not, and how to handle the problems. During that time the students were completing the tasks. They should refer to the module as the main resource of the course and CLS as guidance for learning independently.

At the last session of the online tutorial, the students filled the questionnaire and some of them were interviewed about the implementation. This paper only described and discussed things that were related to CLS guide for science ODL students and the results are below.

Out of 30 students followed the online tutorial that integrated CLS guide, 96% students said that the CLS guide was easy to understand. This was supported by the results of students' interview that the CLS guide presented systematically and straightforwardly, so made it was easy to read. In addition, 89% students said that the CLS guide was to the point, concise, simple and understandable. The usefulness of CLS guide was felt by the students. There were 96% students agreed that the CLS guide could be used as a reference for learning independently. Besides those, 93% of the students stated that the CSL guide encouraged them to apply it in a process of learning. Some of them wanted to implement this strategy when they taught the subject in the class. Moreover, there were students who said that the CLS motivated and inspired them to implement in a learning process. It was relevant to the study of Puspitasari [8] that the CLS that she used in her research are useful, motivate her students to be more discipline.
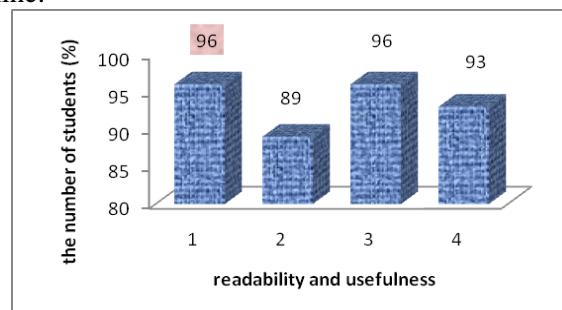

Figure 1. the average students' comments on the readability and usefulness of CLS guide for science ODL students

Note: 1 = easy to understand; 2= conciseness; 3= usefulness as SRL reference; 4= usefulness as encouragement of students' learning

Based on students' comments, it seems that the CLS guide for science ODL students can be used as a reference for independent learning. It is really helpful for ODL students who are demanded to have a high level of self-regulated learning skills. By reading and learning the guide, students are encouraged to plan, monitor, and regulate their learning better. □

Regarding the implementation of the CSL for science ODL, some of students faced some difficulties. First, some of students found difficulty in managing time effectively. The students could not manage time effectively. They lack skills in managing time for being busy in teaching and at the house. So, they had no time to make a summary, to read and learn the module as the schedule that has been made. Second, the students found the difficulty in establishing a realistic short-term goal. The students had already been registering many subjects. So finally, when they made a priority of doing a task, they chose easy tasks. The course of Animal embryology was a subject that was quite difficult to learn and it was not relevant to the subject that they taught to their students at a school. Third, some of students found difficulty in doing monitoring and evaluation of the learning target and schedule. It was hard to do because many schedules could not be obeyed, so the targets could not be achieved. Fourth, there was student found the difficulty in arranging mind mapping. It was hard to do because they did not really understand what they read.

Concerning these obstacles, it was concluded that the students' problems were related to the characteristics of ODL students. Learning for ODL should consider a need of the students. Most of the ODL students continue to study to a get relevant degree and better career. They need linkage between what is being studied with application in life [6] as a science teacher. The students preferred other course material that was related to their life and their need.

4. Conclusion

The Cerdas Learning Strategy Guide for science ODL students is readable and useful. It can be used as a reference. It assists students in independent learning and encourages students to adopt independent learning strategies. However, during eight-week practices, some of students experienced difficulties in applying it, specifically when managing time effectively, setting realistic goals for short-term learning, monitoring, and evaluation, and making a mind map. It needed more time to train for students to use this guide, so the obstacles could be handled.

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