

Cluster analysis on self-regulated learning to anticipate the success of online learning

Dwi Sulisworo^{#1}, Ika Maryani^{#2}, Ariswan^{*3}, Aris Thobirin^{#4}

[#]Ahmad Dahlan University, Indonesia

^{*}Yogyakarta State University, Indonesia

Abstract—Strategies in Covid-19 mitigation positively acquire changes individuals' conduct. Teachers and students hurry to change their interaction using online learning. In online learning, where learning control is higher in students, SRL becomes an important issue to study. This research is a quantitative descriptive study to explain how the SRL profile of students in Covid-19 emergencies. The data were gathered using Google Form. The SRL questionnaire covers four subscale: planning (5 items), monitoring (6 items), controlling (6 items), and reflecting (5 items). Profile of SRL primary school students are grouped at high, moderate-low, and low SRL compared to the average SRL of all students. However, students as a whole tend to have quite high SRL. So it can be expected that students will not encounter learning problems by using online learning.

Keywords— Self-regulated learning, online learning, primary school, learning achievement, learning outcomes

I. INTRODUCTION

The spread of the COVID-19 occurs in all countries. This pandemic incident was taken seriously by various sectors including in the world of education. Indonesia, as a country with a substantial population, has issued various policies in the implementation of learning. All schools in Indonesia are encouraged to do distance learning by utilizing information technology. There are many public responses regarding this policy. In general, all parties agreed to this policy. The main obstacle to the implementation of this learning is the availability of facilities and infrastructure in several areas. Many telecommunications industry providers in Indonesia have prepared a free bandwidth quota of up to 30GB per person to be able to take part in online learning. In Indonesia, the penetration of information technology has been quite high [1]. But, in normal situation, schools have not created policies for utilizing information from the internet in learning [2].

It encourages the formation of behavior capable of self-regulation in managing information as part of the learning process becomes essential for students [3]-[6], including elementary students [7], [8]. Self-regulated learning (SRL) refers to the deliberate and strategic adaptation of the learning process to change cognitive, motivational, and behavioral outcomes [9], [10]. Policies in this emergency certainly bring changes in people's behavior. Educators and students hasten to be able to adjust to the new interaction behavior of online learning. Various interaction applications begin to be learned quickly. They are used in learning, in the beginning of online learning adoption, such as Moodle, Edmodo, Google Classroom, Schoology, Zoom, and others. There is high optimism in the implementation of this learning from educators. This optimism certainly also has implications for students' readiness to engage in learning.

Many research results show that online learning fails because there is no social presence in learning. Students become burdened with academic assignments that sometimes exceed the burden when learning in class. This action is because educators do not measure this burden in an emergency. On the other hand, it is necessary to see whether students have the ability to manage themselves.

The ability to manage oneself is an essential factor in achieving learning goals. Students who have high ability in SRL will tend to be more successful in achieving learning goals. In online learning, where learning control is higher in students, SRL becomes an important issue to study. This research is a quantitative descriptive study to explain how the SRL profile of students in Indonesia in online learning is carried out in Covid-19 emergencies.

II. LITERATURE REVIEW

SRL is an essential factor in the learning process. From some literature studies about SRL, this concept refers to the deliberate and strategic adaptation of the learning process to change cognitive, motivational, and behavioral outcomes [9, 10]. Self-regulation refers to the proactive application of self-directive processes, cognitive behavior, and emotions to achieve goals, learn skills, and manage emotional reactions [9], [11], [12]. In online learning, where student focus becomes important, SRL becomes a factor that needs special attention by educators to ensure the success of the learning process.

The process of self-regulation can be defined as the activities of individuals in making plans, monitoring those plans, making changes to stay on track, and reflecting on what works and what can be improved in the next time [13]. One of the instruments in SRL measurement is to use the Independent Regulatory Formative Questionnaire. This questionnaire measures the perception of students' level of proficiency in four essential components of self-regulation: Planning and articulating what students want to achieve; Immediately monitor progress and disturbances related to student goals; Control change by implementing specific strategies when things do not go according to plan, and Reflect on what works and what students can do better next time [9].

Self-regulation in online learning is the ability to bring up and monitor one's thoughts, feelings, and behaviors to achieve learning goals by using online applications and the features available. Self-regulation of learning is essential, so students have independence in learning to use information from the internet [14], [15]. It is the ability of a person to maintain or change his personality to follow moral values in society [16] using their competence [17] in cyberspace. The aspects of SRL are metacognition, motivation, and affirmative action. Stages of good self-regulation can encourage the achievement of expected learning goals [18], [19]. SRL can also be in the form of cognitive regulation, motivational regulation, behavioral regulation, and emotional regulation [9], [20], [21] when individuals interact with other students and teachers. It is inseparable from the social support provided to them. The teacher's ability to provide an online environment that is socially similar to real conditions is a key success factor in online learning that supports students' SRL.

III. METHOD

The research began on March 16, 2019, three days after the establishment of the WHO on Covid-19 pandemic. Respondents selected by accident sampling at several schools (24 schools) have implemented online learning after the designation of this mode by the Indonesian Ministry of Education and Culture on March 15, 2019. School-level of respondents from levels 1st to 6th grade students. The data were gathered using Google Form (from 16 to March 19, 2019) through headmasters who carry out online learning and are willing to volunteer for this data collection. The number of samples is 2,204 students. In preliminary analysis, there were the invalid data (blank points, and extremely high or low score). Finally the number of data was 2,154 students.

The instrument used was a questionnaire with a scale of 1 to 5 (from strongly disagree to strongly agree). The overall SRL questionnaire was found to be highly reliable (22 items; $\alpha = .896$) as tested previously. The planning subscale consists of 5 items ($\alpha = .632$), the monitoring subscale consists of 6 items ($\alpha = .704$), the controlling subscale consists of 6 items ($\alpha = .744$), and the reflecting subscale content of 5 items ($\alpha = .682$).

There are two analytical techniques used, namely, descriptive statistics and Cluster Analysis. Descriptive data (average and standard deviation) explain the comparison of each factor profiles between schools. Cluster Analysis is used to see the grouping of students based on SRL profiles.

IV. RESULT

Based on data obtained through the Google Form shared with students participating in online learning, obtained SRL profiles in each aspect, as in Table I.

TABLE I
DESCRIPTIVE (OUT OF 100)

Aspects	N	Min	Max	Mean	STD Deviation
Planning	2154	28.00	100.00	77.0139	11.8757
Monitoring	2154	27.00	100.00	72.1031	12.1312
Controlling	2154	20.00	100.00	72.3426	10.0989
Reflecting	2154	20.00	100.00	74.3008	9.7403

From the average grade, SRL students tend to be quite high. The assumption is that the cut off is 70. To be able to see more deeply the grouping of students' SRL profiles, cluster analysis is needed.

Cluster analysis results by selecting 3 clusters (based on the Elbow technique), Table II shows the grouping that occurred.

TABLE II
FINAL CLUSTER CENTERS

	Cluster		
	1	2	3
Zscore(plan)	0.78549	-0.13162	-1.28774
Zscore(monitor)	0.88331	-0.25469	-1.17006
Zscore(control)	0.77317	-0.14657	-1.22319
Zscore(reflect)	0.79552	-0.14897	-1.26333

The results of the conversion of Table II into an SRL grouping graph are Fig. 1. From this figure, there are three groups with different characteristics. The ANOVA test for these three groups had significant differences.

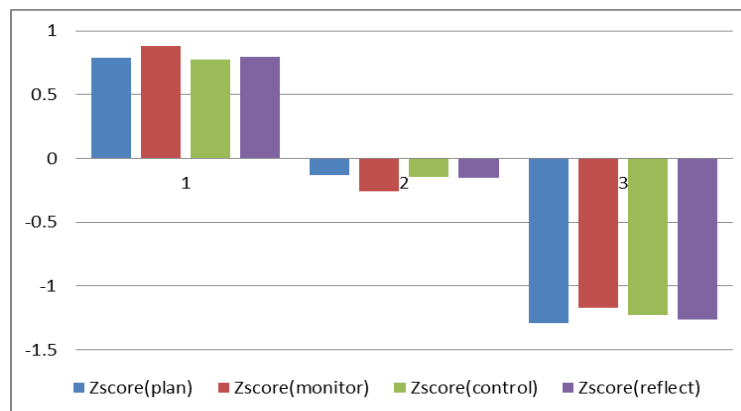


Fig. 1 The cluster result

The number of members per cluster is 809 for cluster 1 (high SRL), 369 for cluster 2 (moderate-low SRL), and 976 for cluster 3 (low SRL). Cluster 3 become the most important to be addressed.

V. DISCUSSION

SRL, both in online learning and not, refers to the ability to understand and control the learning environment. The ability of SRL includes the ability to set goals (Planning), self-monitoring (Monitoring), self-instruction (Controlling), and self-reinforcement (Reflecting) [9], [11], [12]. SRL cannot directly measure academic performance. SRL is more related to mental abilities or skills in achieving a goal that can be related to various things. The increase of SRL is through a development process that arises from

guided practice and feedback so that the behavior will change mental abilities with new skills and habits. In online learning, students who have an excellent SRL will be better to deal with the learning environment change that is different from their real world. With good SRL, students can find, choose, use, information from the internet to solve problems or achieve learning goals. From the results, it appears that primary students are grouped in three: high, moderate low, and low of SRL. It means that students in general still need assistance to improve their SRL. Some findings in online learning during Covid-19 mitigation show that teachers in the beginning adoption of online learning tend to give higher assignments (academics presence) to each subject. This result will affect the work load by students. With inadequate SRL skills, it can happen that they have encountered a flurry of online learning.

The ability of SRL will determine learning outcomes, teachers and school policymakers need to consider including the process of assisting in strengthening the SRL in the learning design. It is essential to determine the strategies that encourage students to apply when dealing with information in cyberspace. Activities to encourage better SRL include explaining the benefits and importance of SRL, teaching SRL strategies explicitly, and helping identify when and how to use SRL when dealing with information from cyberspace for their learning [4], [11]. The expectation of this activity is an increase in SRL in primary school students. Digital technology faced suddenly because of Covid-19's mitigation will affect students' daily activities.

Based on experiences in joining and conducting e-learning courses, there are at least two critical points to enable learning to happen. Setting and informing explicitly the learning objectives help the learners become aware of what to achieve by the end of the learning process. Also, asking the learners to write their feedback is of significance. Through it, they can self assess what they learned and achieved, describe how they felt, inform what challenges or even difficulties they got during the learning session. At the same time, the teacher can also get the feedback to evaluate the program and measure the success or failure in facilitating the learners in achieving the objectives. The way teachers organize online learning can have a profound effect on the ability of students to become independent learners [22]. An essential factor in online learning is not only delivering content or problem-solving. The teacher should explicitly nurture students on how to learn. These activities include determining a particular approach to a problem, conducting dialogue, both synchronous and asynchronous, to produce and evaluate shared ideas. When choosing a learning strategy, explain the reason why this approach used in online learning. Students in new learning materials generally do not know which strategy is best to use, and they may lose motivation if not trained and encouraged [12]. Communication to understand this online is essential. When techniques that are understood and learned are useful in a particular activity, motivation and self-satisfaction will increase.

VI. CONCLUSION

Profile of SRL primary school students are grouped at high, moderate-low, and low SRL compared to the average SRL of all students. However, students as a whole tend to have quite high SRL. So it can be expected that students will not encounter learning problems by using online learning. Teacher assistance in enhancing SRL needs to be designed more clearly as a learning strategy. In this way, students can achieve the continuity of successful learning in online learning. Based on data obtained from cluster analysis, the in-depth analysis may be applied by mapping students based on the cluster of each school. From this new profile, policy-maker can develop a school-based SRL improvement policy.

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