Developing a Self-regulated Learning Scale for Online Learning

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During the COVID-19 pandemic, Japanese primary and secondary school students quickly gained access to online ICT lessons and on-demand content. In this study, we attempted to develop a self-regulated learning scale that is a prerequisite for developing a learning support system for students taking tests and using a content provision system supported by AI in a private tutoring school. A pilot survey was conducted from July to August 2021 and the main survey was conducted in December 2021, using a questionnaire of 57 items chosen primarily from previous studies. A scale with six factors and 41 items was created. As a result, the scale developed includes the items related to the forethought phase and to the beginning of performance phase of SRL. This suggests that guidance before students start learning or in the early stages of learning could be effective.
In the future, we will reexamine the validity of the scale and explore the relationship between the scale and the group of students with high grades or those with improved grades, which will lead to the development of learning support methods.

Keywords: Self-Regulated Learning, Scale Development, COVID-19 Pandemic, Learning Support, Online Learning

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Introduction

Background

During the COVID-19 pandemic, online learning using ICT and on-demand content usage have rapidly expanded in Japanese elementary and junior high schools since 2020. In addition, the Global and Innovative Gateway for All or "GIGA" school initiative promoted by the Japanese government has been advanced by the pandemic, and it is becoming possible for each person to own a tablet (Ministry of Education, Culture, Sports, Science and Technology, 2022). Therefore, in the last two years, the barriers to online learning have been removed for Japanese elementary and junior high school students in terms of both hardware and content, and many children are actually learning online on a daily basis.

Children studying in this new learning environment require Self-regulated Learning (SRL) skills at a higher level than ever before. According to Zimmerman (2015), "Self-Regulated Learning involves metacognitive, motivational, and behavioral processes that are personally initiated to acquire knowledge and skill, such as goal setting, planning, learning strategies, self-reinforcement, self-recording, and self-instruction." In short, SRL is a series of skills that allow learners to study on their own efficiently and effectively.

In Japan's fast changing society, where aging is progressing at a rapid pace and adult learners are being promoted to relearn, SRL was being emphasized even before the COVID-19 pandemic in order to realize the goal of a lifelong learning society. With the onset of the pandemic, the importance of SRL has risen as it provides a practical means to learn in an asynchronous distributed environment for learners ranging from elementary school children to adults.

In informal education, which has adopted ICT utilization more flexibly than public education, the transition to online is more remarkable than in elementary and junior high schools. The largest sector in the private educator industry in Japan is "Juku." In contemporary Japan, Juku refers to a private preparatory school for university/high school entrance examinations. According to the Japanese government records, there are 47,734 Juku schools all over the country and this number is more than double the sum of junior high and high schools. Approximately 3.4 million students were enrolled at Juku schools in2018 (Ministry of Economy, Trade and Industry, 2019).

In particular, individualized instruction at Juku schools has succeeded in providing educational services that individually optimize learning content and learning progress. The move to online has meant that learning support goals have been added to allow individual students to regulate themselves. Therefore, in addition to the learning status data, i.e., system access log, operation log, and grade data that can be readily used in present times, there is an increasing need to grasp the SRL readiness data of children and students at Juku schools.

Purpose of Study

Many SRL scales have already been developed and utilized, including the commonly used Motivated Strategies for Learning Questionnaire (MSLQ) proposed by Pintrich and Degroot (1990). However, these scales are inadequate to measure the SRL readiness of elementary and junior high school students studying during the pandemic who have been faced with a situation in which SRL is required in an online learning environment. Therefore, this study will present an SRL scale that will be used for developing a learning support system for elementary and junior high school students who are conducting SRL using an optimization problem presentation system by AI at some franchise schools of A-Juku company (collectively called A-Juku hereafter).

Research Design & Methods

Pilot Research

The pilot survey was conducted to select items that have expressions that elementary and junior high school students can understand. That is, the scale was developed by collecting data twice and performing exploratory factor analysis. In both surveys, in order to ensure the diversity of the respondents, we targeted children from three or more Juku schools in the Kanto region that constitutes the metropolitan area of Japan. First, questionnaire items were selected by the teachers of A-Juku from the SRL scales for Japanese learners developed by previous studies (Fujita, 2010; Igarashi, 2019; Maeda et al., 2012; Miyabe et al., 2016; Narita et al., 1995; Sato & Arai, 1998; Seo 2007). Subsequently, items with overlapping contents and those that can be used only in face-to-face classroom interactions were excluded. Overall, 67 items were selected through this procedure. Using them, we created a five-point Likert scale with responses ranging from 1 = I don't agree to 5 = I agree, and a preliminary survey was conducted on 60 students (from 5th to 9th grade) attending A-Juku between July-August 2021. Factor analysis (maximum likelihood method and promax rotation) was performed on 57 items excluding 7 items for which the ceiling effect was observed and 3 items for which 20 or more participants did not answer.

The number of factors was determined by a screen plot from the results of the items with an eigenvalue of 1 or more, and 44 items and 9 factors were adopted with a factor loading of 0.3 or more.

Main Research

In order to develop a more reliable scale, a larger survey was conducted in December 2021 using a 44-item questionnaire extracted from the pilot survey, and valid responses were obtained from 238 students of A-Juku. Respondents belonged to grades 5th to 9th, as in the pilot survey. Factor analysis was performed on the responses using the maximum likelihood method and promax rotation again, and three more items were excluded based on the factor load of 0.3 or more, and the number of factors was adjusted by the screen plot.

Results

From the factor analysis of the results of the second survey, a scale of 41 items under six factors was created as shown in Table 1. Since the first factor consisted of items related to learning plans and preparations before the process of learning started, it was designated as "planning/learning environment management." The second factor is "utilization of metacognition" because it includes the content to objectively grasp and control one's own learning. The third factor represents concerns and negative emotions about the test and was named "test anxiety." The fourth factor is "dependence on teacher" because it indicates a situation in which teachers are relied on more than necessary. The fifth factor is called "shallow learning strategy" because it requires simple memorization and an increase in the amount of learning. The sixth factor includes the externalization and evaluation of one's own learning method and is called "utilization of externalization."

In addition, the correlation between factors was confirmed. There was a moderate correlation between factor 1 and factor 2 (Table 2). According to Zimmeman (2015), SRL takes the form of a cycle of three phases: a forethought phase, a performance phase, and a reflection phase. The correlation suggested that students who were more conscious of self-regulation in the forethought phase may utilize metacognition and control themselves in the performance phase as well.

Table 1

Result of exploratory factor analysis (N=238)

Factors and Items	F1	F2	F3	F4	F5	F6	c
Factor 1. Planning and Learning Environment Management α=.881							
When I study, I make a plan prior to starting.	**.88**	-.08	.06	-.06	-.06	.01	.68
When I study, I follow my own plans.	**.79**	-.02	.06	.02	.02	-.09	.59
I make a plan before studying for the exam.	**.79**	.02	.04	-.09	.08	-.12	.56
I am confident that the plan I made can be realized well.	**.74**	-.17	-.15	.02	-.03	.20	.60
*It's hard to get motivated and start studying.	**-.65**	.21	.19	.02	.23	-.07	.42
I plan a week of study and act.	**.57**	.01	.07	.02	.06	.24	.49
I set a time to study.	**.57**	.10	.05	.00	-.05	-.08	.38
In order to motivate myself to study, I begin after deciding the amount and time.	**.56**	.15	-.02	.16	-.04	-.13	.48
If I want to do something, I'll start right away.	**.46**	.15	-.22	-.04	.03	.07	.35
I adjust the temperature and brightness of the room to make it easier to study.	**.39**	.11	.02	.02	.17	-.05	.23
I remember that I had a good test before to motivate myself to study.	**.34**	.07	.00	.05	.08	.21	.26
If there is something I don't understand in my studies, I will try different ways of studying.	**.31**	.26	-.01	.04	.15	.27	.43
Factor 2. Utilization of Metacognition α=.814							
When I do not fully understand the content during class, I will understand it later.	-.04	**.75**	-.19	.08	.05	.02	.57
When asking a teacher, I ask them to give me hints on how to solve it myself, rather than answering it.	-.02	**.60**	-.32	-.02	.12	.06	.41
When I'm studying, I try to find out things I don't understand.	-.04	**.57**	.10	.11	-.05	.24	.47
When I stumble upon a problem, I think specifically about what information has been provided in the problem.	-.05	**.57**	.11	-.12	-.13	.20	.38
When I can't solve the problem, I wonder if there is another way.	-.13	**.56**	-.06	-.10	.01	.21	.28
Before I study, I think about what I have to study.	.19	**.50**	.17	.01	-.05	-.08	.43
When I'm studying, I make sure that I remember what I learned.	.02	**.50**	.05	.00	.11	.13	.29
When I study and think something is important, I'll write it dow n in a notebook without being told.	.05	**.45**	-.05	.01	.00	.08	.24
When I can't solve the problem, I can notice what I'm missing.	.22	**.43**	.08	-.04	-.13	-.06	.36
It is very important to study a lot.	.13	**.39**	.12	-.10	.26	-.01	.26
When asking the teacher to explain, I ask them to explain not on ly the answer but also the way of thinking.	-.08	**.30**	.05	.19	-.13	.06	.17
Factor 3. Test Anxiety α=.693							
I wonder how inferior I am to my classmates when I take the test.	-.08	.06	**.69**	-.12	.05	.13	.50
When I take the test, I think about bad results.	-.07	-.05	**.69**	-.08	.04	.09	.49
I feel anxious and upset when I take the test.	.08	.01	**.66**	.05	.05	-.20	.50
While studying I think about whether the way of studying suits me.	.12	.16	**.41**	.13	-.16	.28	.42
*My test scores are always close to my own expectations.	.11	.16	**-.37**	-.12	-.03	.23	.25
Factor 4. Dependence on Teachers α=.723							
When I encounter something I don't understand, I ask the teacher rather than looking it up myself.	.00	-.02	-.06	**.78**	.05	-.13	.58
If I don't understand something, I immediately ask the teacher.	-.11	.30	-.12	**.69**	-.10	-.01	.60
I ask the teacher a question, even if I can understand it with a little more thought.	.04	-.12	.04	**.65**	.00	.22	.52
When I encounter something I don't understand, I ask the teacher to solve it rather than thinking for myself.	.11	-.24	.08	**.40**	.30	.15	.39
Factor 5. Shallow Learning Strategy α=.535							
If the answer is correct, its reason doesn't matter for me.	-.09	-.23	-.05	.02	**.61**	.03	.50
If the answer is correct, another way to solve the problem is not particularly important.	-.09	-.04	-.07	.02	**.45**	.00	.22
I try to remember the answers to the questions that are likely to be tested.	.15	.05	.04	.05	**.39**	-.08	.20

If there is something I don't understand in my studies, I ask my friends for the answer.	-.07	-.02	.08	-.08	**.37**	.25	.22
If I don't understand the materials distributed in class, it's because I didn't work hard.	.07	.15	.11	-.10	**.32**	-.01	.13
Good grades are determined by the amount of study, rather than the way of study.	.06	.10	.16	.12	**.32**	-.02	.19
Factor 6. Utilization of Externalization α=.508							
While asking a question, I explain my thoughts to the teacher.	-.13	.36	.05	.09	.01	**.45**	.33
To motivate myself to study, my friends and I teach each other and share problems.	.06	.27	-.03	-.04	-.05	**.42**	.29
I think my way of studying is good.	.24	.21	-.19	-.03	.06	**.32**	.33

＊：Reverse Item, c：Commonality

Table 2

Factor correlation matrix (Pearson)

Factor	1	2	3	4	5	6
1	1.000					
2	0.512	1.000				
3	0.008	0.085	1.000			
4	0.374	0.302	0.101	1.000		
5	0.030	-0.160	0.097	0.136	1.000	
6	0.286	0.090	-0.018	0.186	0.085	1.000

Discussion

As a result, the scale developed includes the items related to the forethought phase and activities at the beginning of performance phase of SRL. Besides, it might be natural for motivated young students to actively communicate with their teachers. We classified the items showing this approach as "dependence on teachers", however, this factor does not only have a negative effect on their learning activities but can also be categorized a learning strategy called help-seeking strategy. In fact, Factor 4 correlated both with Factor 1 and 2.
As apparently negative factors, factors such as "test anxiety" and "shallow learning strategies" are also extracted, and these are also considered to affect the performance phase. This suggests that guidance before students start learning or in the early stages of effective learning could be effective.

Of the six factors obtained in this study, the values of the α coefficient were low for 3, 5 and 6 (Table 1). Therefore, in the future, we will conduct a larger-scale survey, perform a confirmatory factor analysis, and sort items. The scale must be reexamined and its reliability should be increased. A questionnaire with 41 items has a high cognitive load for elementary and junior high school students, so we plan to exclude items that show a high load on multiple factors and items that are unlikely to lead to learning support. This would help us develop a scale with fewer items and higher effectiveness.

In addition, after the finalized scale is constructed, the relationship between the scale score and grades and learning activities will be confirmed by subject and grade. Through this verification, we plan to extract items and factors that are highly correlated and related to those variables. Further research will examine how this scale can be used in learning support systems.

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References

Fujita, T. (2010). A study of the relationship between metacognitive strategies and the academic procrastination behavior in college students. Bulletin of Center for Educational Research and Development of Nara University of Education, 19, 81-86.

Igarashi, R. (2019). A study of relationship between self-regulated learning strategy and active class attitude in college students. Minamikyushu University Journal of the Human Development Research, 9, 35-44.

Maeda, K., Enta, H., & Niimi, N. (2012). Relationship between learning strategies for favorite or unfavorite subject and self-efficacy. Hiroshima Psychological Research, 12, 45-59.

Ministry of Economy, Trade and Industry (2019). *Survey report on the actual situation of specific service industry*. https://www.meti.go.jp/statistics/tyo/tokusabizi/result-2/h30/pdf/h30report27.pdf

Ministry of Education, Culture, Sports, Science and Technology (2022). *On the realization of the GIGA school initiative*. https://www.mext.go.jp/a_menu/other/index_00001.htm

Miyabe, M. A., Togashi, A. C., Othuka, S. Y., & Sato, C. (2016). Reliability and validity of a Japanese version of the motivated strategies for learning questionnaire for motivation scales. *Journal of Japan Health Medicine Association*, *25*(Supplement), 276-286.

Narita, K., Shimonaka, Y., Nakazato, K., Kawai, C., Sato, S., & Osada, Y. (1995). A Japanese version of the generalized self-efficacy scale. *Japanese Journal of Educational Psychology*, *43*, 306-314.

Pintrich, P. R. & Degroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33-40.

Sato, J., & Arai, K. (1998). The relation between the use of learning strategies, learning goals and causal attributions. Tsukuba Psychological Research, 20, 115-124.

Seo, M. (2007). Autonomous and dependent help-seeking in mathematics: Beliefs about learning and strategies for checking failures in problem solving. *Japanese Journal of Educational Psychology*, 55, 170-183.

Zimmerman, B. J. (2015) Self-regulated learning: Theories, measures, and outcomes, *International Encyclopedia of the Social & Behavioral Sciences,* (2nd ed; Vol. 21), 541-546.