온라인 토론학습에서 스캐폴딩과 자기규제가 참여와 수행에 미치는 효과

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Facilitating Adult Learning : The Effects of Scaffolding Strategies and Self-Regulation on Discussion Participation and Performance in Online Learning

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■ Abstract ■

As the life expectancy of human beings gets longer and our society changes into highly competitive arena, the implementation of online adult learning is growing, and therefore the learners in self-regulated scaffolding learning environments is becoming an important topic. This study is to investigate the main effects of scaffolding and self-regulation and the interaction effect on discussion participation and comprehension in online learning environments. To do this, ninety-nine adults taking online learning courses with the open university in Korea were investigated. Adult learners were divided into one of the four groups (no scaffolding, *conceptual*, *strategic*, and *conceptual* and *strategic* scaffoldings). Regarding self-regulation, learners were divided into two groups (low and high self-regulated) based on the mean score of subjective report of self-regulated learning. The results are as follows : First, 'strategic scaffolding' is more effective than 'conceptual scaffolding' in discussion participation ($F = 2.772$, $p < .05$) and comprehension test ($F = 7.156$, $p < .05$). Second, high self-regulated learners more actively participate than low self-regulated learners in discussion ($F = 6.230$, $p < .05$), and achieve higher scores ($F = 4.863$, $p < .05$). Third, there is no interaction effect between scaffolding strategies and the level of self-regulation. The theoretical and practical implications of these findings are discussed.

Keyword : Online Learning, Online Discussion, Scaffoldings, Self-Regulated Learning

1. Introduction

As the life expectancy of human beings gets longer and our society changes into highly competitive arena, the demand of adult learning is rapidly increasing. Besides, transitional periods such as the Information Revolution offer tremendous occasions for learning (Bear, 2012) and adult learners participating in this revolution use online learning to ensure that a wide array of learning opportunities are available for them (Barr and Miller, 2013). For such reasons, online learning is rapidly growing in adult education and the learners in self-regulated scaffolding learning environments are becoming an important topic (Bai, 2012).

Online learning, learning by means of a personal computer, or computer networks, is a way largely utilized and a discussion forum is often adapted as an interaction tool to help students' learning improvement (Hwang and Yang, 2008). Online learning could make learners acquire knowledge and skills immediately when they want it. Most of all, 'online discussion' promotes the interaction among learners through the 'many-to-many' communication system. Potential effectiveness of online discussion is infinite because it is feasible for learners to communicate asynchronously as well as synchronously; that is, learners can communicate beyond time and space. However, in reality, 'online discussion activity' is not so much active as we expect. While online technology supports interactive communication environments, it does not guarantee interaction itself (Jonassen and Kwon, 2001).

Therefore, many researchers have tried to overcome this problem using various 'scaffoldings' (Choi et al., 2005; Kramarski and Mizrachi,

2006a, 2006b). scaffoldings are tools, strategies, and guides that frequently used in learner-controlled environments. It can be provided by human (i.e., teachers and peers), or computer tutors and animated pedagogical agents during learning to enable learners to develop understanding beyond their immediate grasp (Azevedo et al., 2005).

Also, 'self-regulation' is one of the critical variables in online learning as well as adult learning. It is personal autonomy or "taking control of goals and purposes of learning" (Bear, 2012). According to Zimmerman (2000), self-regulation is the degree to which learners are able to become matacognitively, motivationally, and behaviorally active participants of their own learning process (Dabbagh and Kitsantas, 2005). That is, self-regulated learners are strategic learners who purposefully control their learning (Hadwin et al., 2005).

In this study, we investigate the adequate combination of scaffoldings and the self-regulation of learners, which are considered as the most critical variables for successful online learning. While most of the related studies so far show that scaffolds are effective to develop learners' self-regulation ability (Azevedo et al., 2005; Dabbagh and Kitsantas, 2005; Hadwin et al., 2005; Puntambekar and Stylianou, 2005, etc.), the current study focuses on the relationship between types of scaffolding and self-regulation, which play central roles in online interactive learning. The distinction between the current study and previous studies is while the previous studies regarded self-regulation as the only results of learning, the current study considers the self-regulation as an independent variable which affects learning as well as the

results of learning.

Hence, the current study aims to investigate how the types of scaffolding approach and the levels of self-regulation affect 'discussion participation' and 'learners' performance' in online learning. In addition, the interaction effect between these two variables, types of scaffolding and self-regulation, is investigated.

2. Online Discussion and Scaffolding Strategies

There has been enormous research applying scaffolding strategies for dealing with learning (Azevedo et al., 2005; Dabbagh and Kitsantas, 2005; Hadwin et al., 2005; Jonassen and Kwon, 2001; Kramarski and Mizrachi, 2006a; Puntambekar and Stylianou, 2005, etc.). Among them, we focus on the research investigating the effects of scaffolding in online discussion.

Puntambekar and Stylianou (2005) examined the effectiveness of scaffoldings in 'hypertext environments'. Hypertext environments could have positive effect on students' learning. However, it could be negative to students because those environments could hinder learning due to the overload of searching the proper learning information. In hypertext learning context, Puntambekar and Stylianou investigated which types of scaffolding could be beneficial for learners. They divided participants into two groups : one group was supported by 'meta-navigation support' and the other one was the control group which has no support. As results, Puntambekar and Stylianou found that the former group performed better than the latter one, and suggested that 'meta-cognitive support' was essential for learners in the hyper-

text instruction in order to achieve successful performance.

Kramarski and Mizrachi (2006a) compared the discussion groups with and without meta-cognitive guidance. In their study, meta-cognitive guidance, which consisted of four questions, was used as scaffolding : (1) comprehension questions, (2) connection questions, (3) strategic questions, and (4) reflection questions. Kramarski and Mizrachi found that the groups provided with meta-cognitive guidance performed better than the other groups on the comprehension test. Therefore, Kramarski and Mizrachi concluded that the meta-cognitive questions have positively effective for students to do self-regulated learning and to be able to lead high-level discussion.

More recently, Darabi and Jin (2013) suggested discussants' cognitive load should be considered to improve the quality of online discussion. Based on CLT principles (i.e., Cognitive Load Theory principle), Darabi and Jin proposed three discussion scaffolding strategies, (1) example-posting, (2) filtered-posting, (3) limited-number-of-posting, and compared these CLT-based discussion scaffoldings to the conventional discussion scaffolding (i.e., a full guidance including all postings). As results, Darabi and Jin found that, compared to a conventional scaffolding group, the discussion quality was significantly enhanced for participants using example-posting scaffolding and limited-number-of-posting scaffolding.

3. Online Discussion and Self-Regulated Learning

The self-regulated learning ability is criti-

cally important variable (Eom and Reiser, 2000; Joo et al., 2000; Young, 1996) because the interaction mechanism in online learning recently changes from 'one-way interaction' to 'two-way co-working interaction' among instructors and learners. In order to make learners do active learning, it is indispensable to offer proper learning environments. However, learners also need to be considered as an important factor. Self-regulation of learners is recognized as a significant variable in learner-controlled environments such as online discussion. Hence, most of related research aimed to investigate how to improve learners' self-regulation through online discussion. While the previous research concentrated on developing 'self-regulated learning strategies' which improve learners' self-regulation, the recent research focuses on developing further practical tools as well as develops self-regulated learning strategies to make learners be self-regulated.

Yang (2006) explored how learners improved their self-regulation in online discussion groups. Yang employed the three self-regulated learning strategies (SRLS) : (1) cognitive strategies, (2) performance control strategies, (3) self-efficacy strategies. Learners were asked SRLS questionnaires before and after online learning. Yang found that learners' ability of 'cognitive strategies' and 'performance control strategies' were improved during online group discussion, while their ability of self-efficacy strategies were not different between pre and post scores. The results implied the importance for instructional design and development of environment in order to promote students' self-regulated learning strategies.

Recently, Bai (2012) suggested 'a self-regulatory tool' for the purpose of facilitating learners' critical thinking, in addition to self-regulated scaffolding strategies, and tested it. In an asynchronous online discussion environment, while both groups were provided with 'critical inquiry' as a self-regulated scaffolding, one of the two groups additionally received 'training' regarding the usage and characteristics of that critical inquiry as a self-regulatory tool. As results, Bai found that the group provided with both 'critical inquiry' and 'a self-regulatory tool' demonstrated higher level critical thinking more frequently than the group provided with only critical inquiry. This result indicates the training regarding how to use self-regulated scaffolding, which is an additional tool to improve learners' self-regulation, could facilitate learners' performance in asynchronous online discussion.

4. Scaffolding and Self-Regulated Learning

In teaching and learning, scaffoldings are described in the two contexts. One kind of scaffoldings could be provided by human teachers, tutors, or peers and the other offered by computer (Lajoie, 2005). The majority of previous research focused on how these different types of scaffolding made an impact on the performance, and contributed to improve learners' self-regulation.

Azevedo et al. (2005) studied how three kinds of scaffolding conditions (i.e., adaptive scaffolding, fixed scaffolding, and no scaffolding) affect students' self-regulation in the hypermedia-based instruction. According to them, 'adaptive scaffol-

ding' meant the condition that learners were provided with 'learning goal' and 'a human tutor' during learning, while 'fixed scaffolding' was the condition provided with 'learning goal' and 'a list of 10 domain-specific questions' which helped students' learning. Also, 'no scaffolding' group was the condition with the only 'learning goal'. In the results, the 'adaptive scaffolding group' was superior to the other two groups in the 'planning', 'monitoring', 'strategies', and 'task difficulty and demands' of variables of self-regulated learning (SRL). However, there was no significant difference among groups on the 'interest.'

Dabbagh and Kitsantas (2005) investigated the web-based pedagogical tools (WBPT) as scaffoldings for improving students' self-regulation. That is, they examined which WBPT was effective in prompting students' SRL. As results, Dabbagh and Kitsantas found that different types of WBPT (administrative and collaborative communication, content creation and delivery, assessment, and hypertext WBPT etc.) affected different types of process of SRL (goal-setting, task strategies, self-monitoring, self-evaluation, time planning and management, and help-seeking, etc.). Dabbagh and Kitsantas reported that WBPT of 'collaborative communication' improved the process of 'goal-setting', 'time planning and management' of the self-regulation. Moreover, WBPT of 'contents creation and delivery' supported 'goal-setting', 'task strategies' and 'self-evaluation' of the self-regulation. These results suggest that the specific types of scaffolding contribute to the related self-regulated abilities. Accordingly, the proper scaffolding strategy needs to be considered for the specific self-regulated abilities.

Most recently, Poitras and Lajoie (2014) also developed a pedagogical agent-based adaptive system for the purpose of improving learners' performance and self-regulation in history education. In their study, Poitras and Lajoie presented 'user-modeling techniques' which combined statistical and computational approaches to assess skill acquisition, practice, and refinement with the MetaHistoReasoning tool, a rule-based reasoning system that allowed pedagogical agent to adapt instruction. That is, the model allowed the agent to detect instances when skills were inappropriately applied by learners. Also, Poitras and Lajoie discussed how this agent system enhanced learning and learners' self-regulation.

5. Conceptual Scaffolding and Strategic Scaffoldings

As we reviewed above, there have been various scaffoldings according to 'providing forms' and 'functions'. Among them, we followed the classification of Hannafin et al. (1999). Hannafin et al. categorized scaffoldings into conceptual, metacognitive, procedural, and strategic scaffolding according to function. In the current study, we chose '*conceptual* scaffolding' and '*strategic* scaffolding' from the four different scaffoldings of Hannafin et al. (1999), because we thought these two scaffoldings were primarily necessary for learners to actively participate in the discussion and reach learning goal.

Generally, *conceptual* scaffolding is regarded as the essential content information on the topics, and *strategic* scaffolding the methods how to approach the topics. For successful 'learning comprehension' and 'discussion participation',

the clear understanding on the subject matter should be primarily preceded, this is why *conceptual* scaffolding was chosen. Meanwhile, even though learners have clear comprehension regarding subject matter, if they do not have concrete strategies, it is difficult to reach the state of meaningful discussion, this is why *strategic* scaffolding was chosen. We assumed if these two guidance could be provided, learning performance would be more effective and the discussion more active. Therefore, we employed *conceptual* and *strategic* scaffoldings in this study.

6. Research Questions

The purpose of this research is to demonstrate how different types of scaffolding and self-regulation interactively affect the discussion participation and learning comprehension in online environments, in particular, for adult learners. Research questions are as follows.

- What are the effects of the different types of scaffolding (*conceptual* and *strategic* scaffoldings) and the level of learners' self-regulation on the online discussion participation?
- What are the effects of the different types of

scaffolding (*conceptual* and *strategic* scaffoldings) and the level of learners' self-regulation on learning comprehension?

7. Method

7.1 Participants and Design

Ninety-nine participants were all adult learners from the one of open universities in Korea. We used a 4-by-2 mixed experimental design with between-subject factor being the different types of scaffolding (no-scaffolding, *conceptual* scaffolding, *strategic* scaffolding, and *conceptual* and *strategic* scaffoldings) and within-subject factor being self-regulation ability (low and high). Regarding scaffolding approaches, 24 learners served in the control group (in which they did not receive any treatment), 28 learners served in the *conceptual* scaffolding group, 23 learners served in the *strategic* scaffolding group, and 24 learners served in the *conceptual* and *strategic* scaffoldings group. Regarding self-regulation ability, the top 50% of students from the self-regulation test were identified as high self-regulated learners and the bottom 50% of students as low self-regulated learners.

〈Table 1〉 Number of Participants in Each Group

	No Scaffolding (Control)	Conceptual Scaffolding	Strategic Scaffolding	Conceptual and Strategic Scaffolding
High SR	13	12	13	14
Low SR	11	16	10	10
Total	24	28	23	24

Note) High SR = high self-regulated learners' group; Low SR = low self-regulated learners' group;
　　　Total = the total group of the students in each condition regardless of the level of self-regulation.

7.2 Materials and Apparatus

The online based learning materials consisted of 'online lectures', 'lecture notes', and 'guidance notes' according to scaffolding strategies. The materials for measurements were 'self-regulation test', 'comprehension test', and 'online discussion participation.' All measurement materials were fully offered in an online environment.

7.2.1 Video-recorded Lectures and Lecture Notes

The learning domain was 'Introduction of Distance Learning', one of the ill-structured learning areas. Online lectures consisted of 14 'video-recorded occasions' conducted by a professor in this field of Distance Learning, and 'lecture notes' were organized by the form of word file. Learners were supposed to access these 'online lectures' and 'lecture note's and download them per week.

7.2.2 Guidance Notes

'Guidance notes' were weekly created based on lecture topics and consisted of three types of scaffolding (i.e., *conceptual* scaffoldings, *strategic* scaffoldings, or *conceptual* and *strategic* scaffoldings). Every week, these notes were individually delivered to learners by email for the purpose of helping their learning. *Conceptual* scaffolding was regarding essential content information on discussion topics, while *strategic* scaffolding was regarding methods how to approach the discussion topics.

7.2.3 Self-Regulation Test

For obtaining self-regulation ability of participants, the measurement by Yang (2000) was used. It consisted of 5-point likert scales. All students were required to test self-regulation before the instruction of the first week, and send the result of the test to instructor by email. Based on their results of self-regulation test, learners were randomly assigned to one of four condition groups.

7.2.4 Comprehension Test

Comprehension test was a mid-term exam composed of five open-questions. Learners were required to write their answers about the question such as "Suggest the desirable instructional model of distance learning and explain the rationale for the answers."

7.2.5 Online Discussion Participation

'Online boards' were used to measure learners' online discussion participation. There were four kinds of online boards according to scaffolding treatments. Learners could have access to the only one designated board, and participated in discussion. They presented their own opinions or ideas regarding weekly lecture topic, and the number of them was calculated every week. The final mark was the sum of scores of every week.

7.3 Procedures

The experiment was conducted during the first half-period (i.e., the first seven weeks) of the course of 'Introduction of Distance Learning.' At the first week, learners were required to take 'self-regulation test', and then randomly assigned into one of the four conditions based on their results of self-regulation.

From the second week to the sixth week,

learners were provided with lecture notes with online lecture, and also guidance notes according to types of scaffolding. The online lecture was generally designed for 2 hours learning, however it could take longer or shorter depending on learners' aptitudes. Typically, learners were required to take the video-recording lectures, and then supposed to participate in online discussion. Discussion topic was provided every week and learners referred 'guidance notes' for online discussion and midterm exam.

The seventh week was used for a midterm exam, which is a comprehension test.

8. Results and Discussion

To establish the validity of effectiveness of the combination between two different variables (types of scaffolding and level of self-regulation) as well as the interaction effect in online discussion and comprehension, the current study used 4-by-2 factorial design.

<Table 2> and <Table 3> show the mean scores and standard deviations for each of the four groups on online discussion participation and comprehension test. The scores were analyzed using 4-by-2 analysis of variance with scaffolding strategies (no-scaffolding, *conceptual* scaffolding, *strategic* scaffolding, and *conceptual and strategic* scaffoldings) and the level of self-regulation (low and high) as independent variables. Tukey tests were followed for the case where the ANOVA yielded significant effects (with alpha less than .05).

〈Table 2〉 Means and Standard Deviations on Discussion Participation for Four Groups

Group	N	Discussion Participation	
		M	SD
No scaffolding group (Control Group)			
High SR	13	14.31	8.28
Low SR	11	8.55	2.84
Total	24	11.67	6.92
Conceptual scaffolding Group			
High SR	12	15.17	10.80
Low SR	16	10.75	4.64
Total	28	12.64	8.03
Strategic scaffolding Group			
High SR	13	34.38	36.41
Low SR	10	17.30	10.74
Total	23	26.96	29.08
Conceptual + Strategic scaffolding Group			
High SR	14	55.07	76.72
Low SR	10	15.10	20.45
Total	24	38.42*	62.42

Note) High SR = high self-regulated learners' group ; Low SR = low self-regulated learners' group;
　　　 Total = the total group of the students in each condition regardless of the level of self-regulation.

<Table 3> Means and Standard Deviations on Comprehension Test for Four groups

Group	N	Performance Test	
		M	SD
No scaffolding group (Control Group)			
High SR	13	58.33	17.35
Low SR	11	59.85	21.99
Total	24	59.03	19.81
Conceptual scaffolding Group			
High SR	12	75.69	18.62
Low SR	16	56.25	19.60
Total	28	64.58	21.23
Strategic scaffolding Group			
High SR	13	83.33	14.83
Low SR	10	79.17	21.61
Total	23	81.52*	17.76
Conceptual + Strategic scaffolding Group			
High SR	14	84.52	19.30
Low SR	10	72.50	18.86
Total	24	79.51*	19.66

Note) High SR = high self-regulated learners' group ; Low SR = low self-regulated learners' group;
     Total = the total group of the students in each condition regardless of the level of self-regulation.

Research question 1 : What are the effects of the types of scaffoldings and self-regulation on the online discussion participation?

A two-way ANOVA showed a significant difference between the types of scaffolding on online discussion participation ($f = 2.772$, $p < .05$). Tukey tests revealed that the *conceptual and strategic* scaffoldings group scored significantly higher than the control group ($t = 26.75$, $p < .05$) and the *conceptual* scaffolding group ($t = 25.78$, $p < .05$). Also, there was a significant difference between high self-regulated learners and low self-regulated learners ($f = 6.230$, $p < .05$). Tukey tests revealed that high self-regulated learners scored significantly higher than low self-regulated learners. However, there was no interaction effect between scaffolding strategies and self-regulation on online discussion participation.

Research question 2 : What are the effects of the types of scaffolding strategies and self-regulation on the comprehension test?

A two-way ANOVA showed a significant difference between the types of scaffoldings on the comprehension test ($f = 7.156$, $p < .05$). Tukey tests revealed that *conceptual and strategic* scaffoldings group scored significantly higher than the control group ($t = 20.28$, $p < .05$). In addition, *strategic* scaffolding group scored significantly higher than the control group ($t = 22.49$, $p < .05$) and *conceptual* scaffolding group ($t = 16.94$, $p < .05$). As expected, there was a significant difference between high self-regulated learners and low self-regulated learners (f

= 4.863, $p < .05$). Tukey tests revealed that high self-regulated learners scored significantly higher than low self-regulated learners. However, there was no interaction effect between scaffolding and self-regulation on the comprehension test.

As well as the effects of each type of scaffolding and self-regulation, ultimately, this experiment was designed to figure out the specific scaffolding for the purpose of supplement for the lack of self-regulation. Therefore, we expected the interaction effect between types of scaffolding and level of self-regulation, but could not find that effect. However, even though there was no significant difference, regardless of self-regulation, the s*trategic* scaffolding was consistently effective. This result indicates that the s*trategic* scaffolding, the method how to approach the learning topic, is primarily important for learners to promote their online discussion and performance.

9. Conclusions

9.1 Main Empirical Findings

The current study aims at revealing how different types of scaffolding strategies and the level of self-regulation affect discussion participation and performance.

The first goal of this study is to determine how the combination of types of scaffolding (i.e., *conceptual* and *strategic* scaffoldings) and the levels of self-regulation affects discussion participation. The results of this experiment report that learners in *conceptual and strategic* scaffoldings group obtained significantly higher scores than ones in conceptual scaffolding and no scaffolding groups. Also, high self-

regulated learners' group scored significantly higher than low self-regulated learners' group. However, the interaction effect between types of scaffolding and learners' self-regulation was not found.

The second goal of this study is to examine how the combination of types of scaffolding and the level of self-regulation affects learning comprehension. The results of this study report that learners in *conceptual and strategic* scaffoldings group and also in *strategic* scaffoldings group obtained significantly higher scores than ones in control group. Likewise, high self-regulated learners' group scored significantly higher than low self-regulated learners' group. The interaction effect between types of scaffolding and learners' self-regulation was not found.

9.2 Theoretical and Practical Implications

The results of this study confirm several practical as well as theoretical implications for the instructional design of online learning. First, the group served with *conceptual* and *strategic* scaffoldings simultaneously performed better than other groups, regarding discussion participation. In the case of the comprehension test, the *strategic* scaffolding group performed better than the *conceptual* scaffolding group. These were the same context with the finding of Kapur, Voilklis, and Kinzer (2008) which analyzed that the participation inequity in early 30~40% discussion has great effect on the entire discussion. As Kapur et al. did, we attempted to investigate what kinds of scaffolding were effective at which critical period, and demonstrated the effectiveness of scaffoldings served in early discussion. In our results,

even though the *strategic* scaffolding served in early discussion period did not affect discussion participation, it consequently influenced on learners' comprehension. Meanwhile, the group served with the *conceptual* scaffolding was trouble-free to participate in discussion because of the core information for topic provided, but that information (i.e., *conceptual* scaffolding) was too difficult to affect learning outcomes. Founded on the results, we suggest that *strategic* scaffolding provided in the early period of discussion is effective on the comprehension of the subject because the *strategic* scaffolding gives learners the methods how to approach the learning topic. On the other hand, the *conceptual* scaffolding has short- term effect on learning. These results have practical implications for the design and development of online discussion tools.

Second, the learners with high self-regulation scored higher than the ones with low self-regulation on the 'discussion participation' and 'comprehension test'. We expected that result, but it is still meaningful in that we made the evidences on how much discussion participation and comprehension were influenced by learners' self-regulation (discussion participation effect size = .533; comprehension effect size = .485). A number of previous researchers assumed that the degree of learners' self-regulation can promote their performance, and so concentrated on how to develop learners' self-regulation. Yang (2006) explored what kinds of self-regulation learning strategies (SRLS) promote learners' discussion. Yang employed three kinds of SRLS and tested them. As results, among 'cognitive strategies', 'performance control strategies', and 'self-efficacy stra-

tegies', the first two strategies were significantly effective. While Yang tried to figure out the specific SRLS to promote learners' self-regulation as well as their performance, our study empirically re-confirms the effects of a relatively low/high level of self-regulation on the 'discussion participation' and 'comprehension.'

Finally, we investigated the interaction effect between the scaffolding treatments and learners' self-regulation on the 'discussion participation' and 'comprehension'. We assumed scaffoldings could play an important role in online learning, and therefore offered scaffoldings for the purpose of supplement for the lack of self-regulation, decreasing the differences of self-regulation among students. As results, while there was no interaction effect between *conceptual* and *strategic* scaffoldings regarding the level of learners' self-regulation, regardless of self-regulation, the *strategic* scaffolding was consistently effective. This outcome also provides useful guidance for instructional designers of online courses.

9.3 Limitations and Future Directions

A limitation of this study is that the types of scaffolding was provided to learners by email, in which learners should check their personal email and then should find what kind of scaffolding they received. After confirming the email, learners had to access the discussion board located in university website, and then finally could participate in discussion. Future research needs to include more technology-enhanced scaffoldings, which make learners more actively involve in online discussion. Furthermore, it needs to be investigated

that technology-enhanced learning systems employing various types of scaffolding, which adapt online instruction according to individual differences of learners.

Another limitation of this study is that the only cognitive scaffoldings were considered when designing scaffoldings for learners who have the low-level self-regulation. In future research, it will be worth investigating the effects of motivational scaffoldings, affective scaffoldings as well as types of cognitive scaffoldings for more effective online learning.

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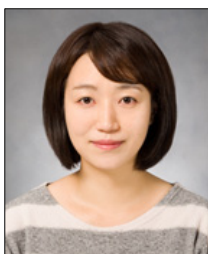
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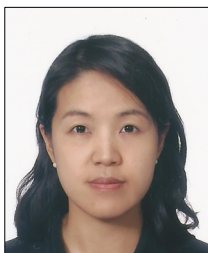
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