Enhancing Self-Regulated Learning in Twice-Exceptional Students Through Diary-Based Scaffolding

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Abstract

This study examines how diary-based scaffolding supports the development of self-regulated learning (SRL) skills in twice-exceptional (2E) students with both talents and learning disabilities. A case study was conducted involving a Japanese junior high school student diagnosed with learning disabilities and autism spectrum disorder, who engaged in daily electronic diary writing and received tailored scaffolding advice over 352 days. The diary entries and corresponding educator scaffolding advice were analyzed to construct a Self-Regulated Learning Support Model. This model includes both an ideal SRL process and an educational model designed to scaffold learners struggling with monitoring and control aspects of SRL. Analysis of the diary entries and corresponding educator scaffolding advice reveal that the participant gained metacognitive awareness, increased learning autonomy, and improved social adaptation. These initial findings are expected to show that diary-based interventions have the potential to empower 2E students by leveraging their cognitive strengths while addressing learning challenges. While this single-case study has limitations in generalizability, qualitative analysis future research are needed to comprehensively verify the model's effectiveness and applicability across diverse 2E populations, and to evaluate its long-term effects. Ultimately, by focusing on both challenges and strengths, diary-based SRL interventions are expected to promote equity for 2E learners and empower them to grow and thrive, offering a promising framework for inclusive and individualized support in special needs education.

Keywords: twice-exceptional, self-regulated learning, diary-based, scaffolding advice, Self-Regulated Learning Support Model

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Introduction

Despite a declining school-age population, the number of students receiving special education in Japan's education system is increasing. This trend highlights the urgent need for individualized educational approaches, particularly for students with dual characteristics (2E)—those who possess both high abilities and significant learning difficulties. The current support system in Japan often focuses on overcoming deficits, neglecting the development of the exceptional cognitive abilities that these students possess.

This study examines how diary-based scaffolding advice can support self-regulated learning (SRL) in 2E students. SRL refers to the metacognitive process by which learners plan, monitor, and reflect on their learning. 2E students possess high cognitive abilities, but co-occurring learning disabilities such as dysgraphia and autism spectrum disorder (ASD) can make it difficult for them to manage their learning independently. Therefore, for 2E students, mastering SRL is essential for overcoming concrete challenges faced by and effectively utilizing their exceptional abilities.

Literature Review

Previous study have highlighted the challenges that students with learning disabilities face in self-regulated learning (SRL) (Girli & Öztürk, 2017). This study emphasizes the importance of targeted support to develop SRL skills in this population. Furthermore, the integration of information and communication technology (ICT) has been shown to mitigate these difficulties and improve the learning environment (Okano, 2019). Zimmerman's (Zimmerman & Schunk, 2013) three-stage SRL model—pre-planning, execution, and self-reflection—provides a robust framework for understanding the process by which students acquire autonomy in learning. Based on these fundamental insights, this study aims to support the development of SRL in 2E student. This is achieved by utilizing diary-based scaffolding advice to identify SRL challenges from student diary entries and providing individualized support to address these challenges. Diaries, especially electronic diaries, have been shown to promote SRL by strengthening metacognitive monitoring and control (Perels et al., 2007), and they also have the effect of reducing the physical difficulties associated with writing. This aligns well with the unique characteristics of 2E students, who require structured self-reflection tools that allow them to address learning challenges while leveraging their cognitive strengths.

Methodology

In this study, we adopted a single-case study design to deeply investigate the long-term changes in SRL of a concrete 2E student. This approach enables a rich and detailed understanding of complex behavioral and cognitive processes that change over time, making it particularly suitable for exploring individualized interventions. Specifically, we focused on integrating personalized support into diary-based scaffolding advice to promote SRL For example, in a case where a student with writing difficulties sought advice on how to respond to a teacher who insisted on handwriting, we facilitated monitoring by asking questions such as, "Why does the teacher insist on handwriting?" and "What are the drawbacks of handwriting?" Based on observations of SRL deficits in diary entries, we defined achievable ideal SRL behaviors, compared actual behaviors with the ideal model, diagnosed the location and causes of challenges, and provided scaffolding advice to overcome these challenges. We attempted to model these processes. The primary objective of this study is to develop and

evaluate a Self-Regulated Learning Support Model that leverages the self-reflective nature of diaries to enhance the SRL skills of 2E students.

Participant

- Japanese 2nd-year junior high school student
- Diagnosed with learning disabilities and ASD
- WISC-IV scores: FSIQ 123, VCI 140, PRI 111, WMI 112, PSI 100
- Primary challenges: handwriting, environmental adaptation, and social communication

Data Collection

- Duration: June 2023 – May 2024
- 352 diary entries and corresponding educator scaffolding advice
- Ethical approval: JAIST Life Science Committee, Approval No. PERSON 06-035

Analytical Approach

The analytical approach of this study comprises of two stages. In the first stage, we construct a Self-Regulated Learning Support Model based on diary activity data. In the second stage, we verify the role of the Self-Regulated Learning Support Model in the acquisition of self-regulated learning (SRL) by the participant and investigate the transferability of the acquired SRL. This paper reports the interim results of the first stage of the study.

In the first stage, we analyzed the participant's daily electronic the diary entries and corresponding educator scaffolding advice. Through detailed qualitative analysis, we identified concrete SRL difficulties faced by the participant. To provide a theoretical foundation for this analysis and the subsequent model construction, we first developed an ideal self-regulated learning (SRL) process, taking into account the unique developmental characteristics of 2E students and referencing existing SRL theories (e.g., Zimmerman's cyclical model).

Subsequently, through an insight-driven, iterative model development process, we developed a self-regulated learning support model. This model provides a comprehensive framework for addressing SRL challenges. Specifically, it supports educators systematically compare observed behaviors with the ideal SRL process to diagnose deficiencies in SRL and their concrete types (e.g., monitoring or control breakdowns).

The ideal model is one of the two main components of the self-regulated learning support model and serves to indicate learning goals. This diagnostic support facilitates interpretation by providing a conceptual lens for understanding the root causes of observed difficulties, taking into account the unique characteristics and context of participants. Ultimately, this comprehensive understanding enables the consideration of appropriate support measures.

The educational model is another component of the self-regulated learning support model and plays a role in considering support for areas of SRL that are not functioning properly. It was constructed by analyzing 352 the diary entries and corresponding scaffolding advice from educators. This model enables the interpretation of difficulties in SRL and the consideration of scaffolding advice by identifying the stage of SRL, and the type of difficulties faced by

learners based on the discrepancies between the behaviors observed in the diaries and the ideal model.

In the second phase, we plan to conduct semi-structured interviews with the participant and their parents. These interviews aim to confirm the acquisition and transferability of self-regulated skills gained through diary activities. Through data triangulation between the first and second part, we will refine conclusions regarding the role of the model.

Results

A Self-Regulated Learning Support Model enables providing appropriate scaffolding advice to learners who are struggling with SRL. In the model construction process, concrete information was extracted from SRL issues observed in the diaries of 2E student, and their characteristics were abstracted from concrete examples and expressed in two to three layers. This abstraction was performed to facilitate the adaptation of the model to the instruction of similar students.

The Self-Regulated Learning Support Model is composed of two interrelated components: an Ideal Model that defines learning goals, and an Educational Model that builds upon this Ideal Model to offer tailored support for learners facing challenges in SRL.

Ideal Model of Self-Regulation

Table 1 summarizes the Ideal Model by presenting different levels of abstraction in the SRL process, from high-level conceptual understanding to concrete behavioral examples. The ideal model is one of the two main elements that make up the self-regulated learning support model and serves to indicate learning goals. This model depicts an ideal state in which problems arising from 2E characteristics can be appropriately self-regulated. This ideal state is characterized by the ability to recognize the causes of problems related to these characteristics (monitoring) and the ability to devise and implement methods to eliminate those causes (control).

This case is based on the diary records of a student who has high abilities but struggles with handwriting. Due to a disability, this student was unable to demonstrate their abilities through handwriting, and when asked to do so by their teacher, they were unable to respond and sought support. The student sought support because they were unable to engage in self-regulated learning. The ideal SRL process is created by extracting the diary entries and associated scaffolding advice. One of these is shown in Table 1. This ideal SRL process consists of five distinct parts: “m-input,” “monitoring activities,” “m-output/c-input,” “control behavior,” and “c-output,” The three rows in the table classify the abstraction level of the SRL process from high to low as “high (H),” “medium (M),” and “concrete (C).” The “m-input” column represents the initial challenges or situations faced by students. For example, “The teacher told me to write by hand, but I disagree” is an example of concrete level of m-input of Monitoring activities. That shows metacognitive process by which students analyze problems and identify their root causes. In the case of concrete input, this includes considering why it is impossible to demonstrate ability by hand due to the nature of the disability. The “m-output/c-input” column represents the understanding gained from monitoring, which forms the input for “control behavior,” are strategic actions taken to address the identified causes. For example, if it is understood that “it is impossible to demonstrate ability through handwriting due to the nature of the disability,” methods for

adapting the requirements are considered. Finally, "c-output" indicates desirable solutions or outcomes of the SRL process, including explanations of the importance of alternative input methods. At the "high (H)" abstraction level. the model addresses general "cognitive dissonance" and explains the ideal process for resolving internal contradictions. At the "medium (M)" abstraction level, the model focuses on more concrete problems (e.g., "unacceptable requirements"), identifies constraints related to the disability, and explains the ideal SRL process for eliminating them. This multi-stage abstraction enables a general understanding of the ideal SRL process and its application to the concrete challenges faced by 2E students. Table 1 systematically presents these ideal responses, emphasizes the critical steps essential for effective SRL, and demonstrates how 2E students can leverage their cognitive strengths, overcome their characteristic difficulties, and actively manage their learning.

Table 1

Example Ideal Model of Self-Regulation

Abstraction Level	m-input	monitoring activities	m-output/c-input	control behavior	c-output
High (H)	Cognitive difficulty.	Consider the causes for cognitive difficulty.	Causes for cognitive difficulty.	Consider ways to deal with the causes for cognitive difficulty.	Actions to deal with the causes for cognitive dissonance.
Medium (M)	I cannot accept the request.	Same as above.	Due to the nature of the disability, the request limits my abilities.	Consider ways to remove the restrictions imposed by the request.	Negotiate to remove the restrictions imposed by the request.
Concrete (C)	I don't agree with the teacher's request to write by hand.	Consider the causes why I cannot accept the request.	Due to the nature of my disability, I cannot demonstrate my abilities by writing by hand.	Think of ways to adapt the request so that I can demonstrate my abilities.	Explain the importance of alternative input methods for me.

Educational Model of Self-Regulation

Table 2 outlines the Educational Model, showing how specific SRL difficulties can be discover and addressed through scaffolding at multiple levels of abstraction. The educational model, which is part of a Self-Regulated Learning Support Model, aims to nurture the learner who has difficulty with appropriate SRL. This model provides a conceptual framework for diagnosing deficiencies in SRL and considering appropriate scaffolding advice. The lack of SRL is identified by comparing the ideal SRL process (shown in Table 1) with the student's diary entries to determine which parts are not functioning appropriately, why, and how to provide scaffolding advice.

In an ideal model that demonstrates sufficient SRL, individuals are able to consider the reasons why they cannot accept a request. However, in reality, individuals are unable to consider the reasons why they cannot accept a request and instead request assistance. This indicates that monitoring is insufficient. Therefore, the educational model promotes

awareness of the necessity of alternative inputs in order to demonstrate one's abilities and provides scaffolding to enable individuals to consider ways to resolve inconveniences. It has been confirmed that this SRL is subsequently transferred.

Table 2 illustrates the process by which concrete SRL issues are diagnosed, and corresponding scaffolding advice are considered within this educational model. The "diagnostic procedure" column explains the systematic approach to analyzing these challenges within the model framework, and the results are presented in the "diagnostic result" column as conceptualized patterns of SRL deficiencies. This process enables educators to understand how the student's observed behaviors deviate from the ideal SRL process.

The educational model serves as a practical framework for providing support based on identified self-regulated learning (SRL) difficulties, as part of a Self-Regulated Learning Support Model. This model was derived from a detailed qualitative analysis of the diary entries and corresponding educator scaffolding advice and was designed with consideration for the unique developmental characteristics of 2E students.

Table 2 shows the comprehensive structure of this educational model. This model classifies SRL difficulties into three different levels of abstraction: high (H) represents fundamental conceptual gaps, medium (M) represents intermediate application issues, and low (C) represents concrete behavioral problems. At each level, the table provides a detailed explanation of the process from "identifying SRL challenges" to "diagnostic procedures" and "diagnostic results," and finally specifies the content of "advice." This model provides a structured approach for educators to systematically understand the challenges of SRL.

Specifically, it supports the diagnosis of a lack of SRL and its concrete types (e.g., breakdowns in monitoring or control) and enables systematic comparison between observed behavior and ideal SRL processes. This diagnostic support provides a conceptual framework for understanding the root causes of observed difficulties and facilitates the interpretation of complex SRL situations that take into account the unique characteristics and context of participants. This comprehensive understanding ultimately provides a foundation for considering appropriate support interventions that foster participants' SRL skills and promote transferability to similar contexts.

It is important to note that this educational model represents a concrete framework derived from our single case study analysis. Alternative models and interpretations of 2E students' SRL challenges may exist. The developed model serves as one effective approach to guide intervention.

Table 2
Example Educational Model of SRL (Education Model for Monitoring Issues Corresponding to Table 1)

Abstraction level	SRL issues	diagnostic procedure	diagnostic result	consideration of advice	scaffolding
High (H)	Unable to consider the causes for cognitive difficulty.	Consider the causes of being unable to consider the causes for cognitive difficulty.	Unable to consider the causes for cognitive dissonance in relation to one's own characteristics.	Build a foundation for considering the causes for cognitive difficulty.	Build a foundation for considering cognitive dissonance in relation to one's own characteristics.
Medium (M)	I can't think of any causes why I can't accept the request.	Same as above.	I am unable to think of causes why I cannot accept requests when considering my own characteristics.	Same as above.	Same as above.
Concrete (C)	I cannot think of any causes why I cannot accept the requirement to write by hand.	I cannot think of any causes why I cannot accept the requirement.	I cannot think of any way to consider the constraints imposed by the requirement while recognizing the importance of alternative input methods for me.	I will consider advice that will encourage me to deeply recognize the importance of alternative input methods for me.	I will lay the groundwork for recognizing that alternative input methods do not unfairly inflate results and only eliminate disadvantages related to my characteristics.

Conclusion

This study, as an interim report focusing on Stage 1, proposed a Self-Regulated Learning Support Model based on diary-based scaffolding advice for fostering self-regulated learning (SRL) in 2E students. This model provides educators with a conceptual and practical framework for supporting learners with complex characteristics, specifically addressing the diagnostic process and intervention planning. While this paper primarily details Stage 1 (model construction), analysis of the participant's diary entries during the application of the Self-Regulated Learning Support Model suggested an association with the student's acquisition of metacognitive awareness and adaptive learning behaviors, alongside observed improvements in their ability to transfer SRL strategies to new contexts, including gains in autonomy and social skills. A comprehensive verification of these acquired SRL skills and their transferability will be thoroughly confirmed through the analysis of interviews with the student and their parents, as planned in Stage 2 of this ongoing research. Future work also includes verifying the applicability of this model to diverse 2E populations and evaluating its long-term effects. By focusing on both challenges and strengths, diary-based SRL scaffolding advice can promote equity for 2E learners and empower them to grow and thrive.

Limitations and Future Work

The diversity of difficulties that each individual faces, which is a characteristic of special education, is a limitation. Even if the main complaint is similar, the background and characteristics may differ, and measures that are effective for one child may not be effective for another. Analyzing the factors that determine the applicability of effective measures is essential for improving the quality of special education. However, this is a research endeavor that cannot be achieved through the individual studies of a single researcher. We hope that this study will serve as a starting point, and that through the cumulative efforts of the research community, tangible results will be achieved. Future challenges. We aim to conduct verification studies with different research subjects. Additionally, we plan to continue investigating the long-term effects of the scaffolding advice.

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