

# *Abstract*

## **Facilitating Contextual Self-directed Learning by Using GOAL System in K-12 Education**

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Self-directed learning (SDL) requires students to take the initiative to learn and control their learning process. It associates a set of skills, relating to competencies to implement the learning process, such as collecting self-data, identifying learning issues, setting and executing plans, and monitoring learning progress. Scholars emphasize SDL as essential for developing lifelong learners. The literature highlights that the demands in 21st-century learning extend from gaining content knowledge to developing skill-based competencies.

Previous research typically employed questionnaire-based assessments with various meta-cognitive aspects of SDL for informing instruction and complementing evidence. They provided empirical evidence for the important influence of SDL on learning achievement. Yet, little understanding of students' SDL behavior in practice is known. On the other hand, most studies were conducted in adult education and university setting. However, a limited of them provided K-12 students the opportunity to practice SDL in authentic learning life. To fill the gaps, this work seeks a way of facilitating SDL in daily life contexts of K-12 education and investigates students' behavior while performing SDL skills.

The current development of educational technology enables personalized support in learning and automatic tracking of students' learning behavior. Considering these benefits and the potential of collecting learning behavioral data, this article advocates an online SDL support environment to enable K-12 students to apply SDL skills in various daily life contexts and help them to improve SDL skills in contextual practice. A GOAL system was developed to construct such an environment, which integrated multiple technologies to support different contexts and provided SDL support following a five-phase process model – the DAPER (Data collection – Analysis – Planning – Execution monitoring – Reflection).

Several quantitative studies were carried out in this research, starting with a pilot study aimed at designing a technical framework to foster the skill to accomplish the Analysis phase of

SDL in multiple contexts, such as learning and physical contexts. The study was conducted with 51 undergraduate students, and the results of the questionnaire showed that 86.3% of the students believed their analysis skills were adequate or better. However, none of them demonstrated a high level of analysis skill using the GOAL system, indicating the students' varied preferences in selecting the context to apply SDL skills.

The second study put forward a learning dashboard to inform students of the context where SDL occurs within the GOAL system. The GOAL system was adopted in an out-of-class self-directed extensive reading context. A two-group study is conducted with 47 high school students during a three-week spring vacation. The results indicated that the group with GOAL system support (N=35) achieved significantly more reading outcomes than those without GOAL system support (N=12). Further analysis of interactions revealed that viewing the learning dashboard had a significant correlation with reading outcomes and SDL behaviors.

Lastly, the GOAL system was applied to support the collection and analysis phases in a self-directed vocabulary and grammar learning context. A single-group study was conducted with 122 high school students over one semester. Four groups of SDL behavior patterns are found by using an unsupervised machine learning method. Further analysis of the final exam scores suggested a positive impact of SDL behavior on their academic achievement.

The results highlight three key findings: 1) a discrepancy exists between students' perceived and performed competency in SDL skills, 2) the proposed system has a significant impact on promoting SDL and learning outcomes, and 3) students' SDL behavior has positive relations with their academic achievement. This research implies the feasibility and importance of facilitating contextual SDL in K-12 education. This article contributes to improving the learning environment for K-12 students to acquire SDL skills in daily life contexts and extending SDL research to study students' actual behavior in contextual practice.