Abstract

**Enhancing Students' Self-Direction Skill with
Learning and Physical Activity Data**

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The 21st century demands the explicit integration of learning and innovation skills, information literacy skills, and life and career skills. Self-direction skill (SDS) has been identified as an increasingly important skill in the education and health domains. Being self-direction would help students to prepare them for success in their future careers, and enables them to engage in lifelong learning. There is a great need for students to develop SDS following the shift from teacher-centered traditional classrooms to learner-centered approaches with advanced technologies.

However, students lack the contexts to practice their SDS, have difficulty with the objective assessment of their SDS, and lack the technological support to develop their SDS. To address these issues, a goal-oriented active learning (GOAL) system was developed. The GOAL system integrates theoretical and empirical knowledge of self-directed learning, self-regulated learning, quantified self, and learning analytics into SDS support components.

In this work, firstly an activity data-rich environment is built in GOAL by synchronizing students' everyday learning activity data, such as reading logs from an e-book reader and physical activity data such as sleep records from wearable devices. Secondly, affordances are designed in GOAL to engage students in self-direction tasks based on the DAPER (Data collection – Analysis – Planning - Execution monitoring - Reflection) model. Each of the five key sub skills of SDS is defined in a separate view to convey the importance of data sufficiency, status identification, smart planning, regular tracking, and strategic evaluation. While students execute any self-direction tasks with the support of GOAL, the system automatically generates their interaction logs. Thirdly, a scoring rubric for each the SDS sub skill is modeled considering students' specific activity data and general trace data. It has five levels from novice learner (level 0) to skilled learner (level 4) and visualized for the learner.

Finally, an automatic adaptive feedback is generated based on the sub skill levels and delivered to learners. Therefore, students are systematically assisted in taking initiatives to "identify their status in contextual activities, set smart goals, monitor their progress, and reflect their strategies".

Furthermore, there has been much less understanding of the effects of SDS on learners' self-directed behaviors, activity-related outcomes, and personal attributes. To address this limitation, this thesis investigated the behavioral patterns in learning and health promotion contexts and further explored the effects of SDS on learners' behaviors, outcomes, and personality attributes. One exploratory study was performed to investigate the behavioral patterns of self-redirection without SDS support and find the needs of support. Three evaluation studies were designed and conducted in K-12 educational settings to investigate the effects of SDS on learners' behaviors, outcomes, and personality attributes.

The results of the exploratory study showed the importance of SDS for high English achievers and the support needs of SDS in order to prevent passive procrastination and maintain regular learning. The first evaluation study in learning found that setting specific challenging goals and regular reviewing had benefits on the successful English learning activity. The second evaluation study in health promotion found that self-tracking and self-planning had a crucial role on the sleep promotion activity. Furthermore, the final evaluation study in learning found that the perception of SDS was a critical factor of SDS, affecting self-directed behaviors, activity-related outcomes, and motivation for the activity.

Therefore, this thesis conducted a theoretical and empirical investigation of the technology support for SDS on needs, design, and evaluation. The findings suggest that a timely personalized feedback based on students' perception, behaviors and attributes in self-direction would be helpful to succeed in lifelong learning. The findings have implications for researchers studying SDS support environments and the effects of SDS on learning and health promotion contexts. Practically, the findings provide suggestions for educators seeking to improve students' learning and healthy activity with SDS usage.