

Goal Setting, Self-Monitoring and Self-Regulation Guided by a Digital Data-Driven Study Assistant

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Abstract: This Research Proposal starts with a brief description of the SIDDATA-project [OsTh18] from which it originates. Both aim at the implementation and investigation of a data-driven digital study assistant supporting university students in goal-setting and self-regulation for individual study goals. As starting point, theoretical backgrounds, such as Goal-Setting-Theory and Social Cognitive Theory are reviewed. Existing practical applications are summarized. From these foundations concrete use cases for our study assistant are derived. The experimental design for an evaluation of the assistant, data analysis methods and a time plan are outlined. Finally the proposal concludes with an outlook on limitations and potential benefits of this research project.

Keywords: goal setting, self-regulation, self-efficacy, higher education, self-monitoring, study assistant, university students, study planing

1 Introduction

This dissertation project seeks to develop and investigate a data-driven digital study assistant. Our assistant will support students in self-determined learning, which we regard as key competence for study success. The study assistants functions relevant in the context of this research proposal are to:

- (1) assist students in developing and pursuing individual study goals
- (2) assist students in self-monitoring their performance in terms of goal achievement.
- (3) assist students in self-regulation, hence the development, application and evaluation of strategies and behaviors for goal achievement.

In this way our study assistant is intended to empower students with the future skills of self-management, autonomous learning and self-efficacy [EhKe19].

The goal of the outlined research is to find out how the scientific insights from section 2 can be integrated into a study assistant and how the how the study assistant can be evaluated. Based on former research, we expect that the resulting software may improve learning outcomes, grades and self-efficacy.

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2 Theoretical Background

Goal Setting Theory by Locke and Latham [LoLa90] describes the positive correlation of goal setting and performance. Relevant moderator and mediator variables which have been investigated are the following:

Feedback is a strong moderator between performance and goals. It has been shown that "feedback is a necessary condition for goals to affect performance"[Erez77]. Effort, which is a strong mediator between goals and performance, is adjusted according to feedback.

Task-difficulty has been shown to be related to performance in a linear function [Lath91] as long as the ability to reach the goal is given. Overcharging goals lead to a decrease of activity and motivation.

Goal specificity assures clearly defined results and lowers variability of outcomes [Lath91]. Hence, the clearer a goal is defined, the higher is the probability that it will be achieved.

Goal intensity is defined by Locke and Latham as "the amount of thought or mental effort that goes into formulating or conceptualizing the goal or a plan of action to realize it." [LoLa90] Goal commitment has been shown to increase through goal intensity.

Goal commitment is a strong moderator in the relationship between goals and performance., especially for difficult goals. Goal commitment can be strengthened by public commitment to a goal, high personal importance of the outcomes, and the belief in the feasibility of the goal [Lath91].

Locke and Latham [LoLa02] name four goal mechanisms that can explain how goal setting increases performance:

1. Goals "...direct attention and effort towards goal-relevant activities...cognitively and behaviorally...".
2. Goals have an "...energizing function...", hence they mobilize resources and increase effort.
3. Goals "...affect persistence...", hence difficult goals lead to longer working times in settings where time is actively controlled and goals can be maintained under distracting circumstances.
4. Goals "...affect action indirectly by leading to the arousal, discovery, and/or use of task-relevant knowledge and strategies...".

Self monitoring is meta-cognitive process focusing on the strategies applied to achieve goals and the outcomes of these strategies. It is the basis of self-regulation.

Self-regulation is often defined as a feedback loop. It can be divided into three phases,

which are iteratively repeated. In the pre-actional phase, goal state and current state are compared and actions chosen to advance towards a goal state. In the actional phase, the chosen action is executed and the actor, the process and effects observed / monitored. In the post-actional phase, the results of the action are evaluated in terms of goal achievement. Based on the evaluation results the next iteration starts.

According to the Social Cognitive Theory of Self-Regulation by Bandura [Band91] "Self-regulation also encompasses the self-efficacy mechanism, which plays a central role in the exercise of personal agency by its strong impact on thought, affect, motivation, and action." Hence, self-regulated learning may also result in an increase of self-efficacy. This may have in a positive impact on affect, motivation and activity [Band91] and in consequence lead to a better performance [Lath91]. These findings show that successful self-regulation in learning contexts may have beneficial effects beyond improved learning and grades.

Proximal and distal goals may unfold different beneficial effects: In 1981 George T. Doran [Dora81] has proposed a way to define goals in a way that he defines as S.M.A.R.T., which stands for: "specific", "measurable", "assignable", "realistic", "time-related". Proximal goals defined in this way can be executed easily, allow action sequence planning and scheduling. The training program based on the Zurich Resource Model [StKr07] uses distal abstract goals, which they call "Motto-goals" to significantly increase activity, motivation and performance.

Morisano et al. have established a software-based goal setting intervention of approximately 2.5 hours of duration which has been evaluated with "struggling" students. This intervention led to a significant increase in General Point Average (GPA), reduced negative affect, and an increase in self-efficacy in the treatment group (Morisano, Hirsh, Peterson, Pihl, & Shore, 2010). This research shows that a software built on the foundation of goal-setting research has the potential to increase not only study success measured in grades, but also lead to beneficial effects on affect and self-efficacy.

The intervention consists of the following eight elements:

1. Elaboration on the ideal future, qualities admired in others, things to do better, career in the future, things to learn about and habits to be improved.
2. Defining at least 7 individual goals and characterizing them in a short descriptive text.
3. Ranking the individual goals according to overall importance, motivation and reachability.
4. Elaborating on impacts of the achievement of a specific goal.
5. Elaborating on goal attainment, sub-goals, strategies and concrete plans and actions.

6. Elaborating on potential obstacles for a specific goal and possible ways to overcome them.
7. Defining benchmarks of success as a basis for self-monitoring.
8. Evaluating Decisions and ranking goals according to commitment.

While this intervention was applied in a single session with a duration of hours, our study assistant will use a different approach.

3 Research Objectives and Approach

The general question the outlined research wants to answer is:

Can scientific insights about goal setting, self-monitoring and self-regulation be utilized by a digital data-driven study assistant to improve the learning outcomes, grades, motivation, activity, self-efficacy and well-being of university students?

This question will be answered by creating a digital assistant and evaluating its effects.

3.1 The digital data-driven study assistant

Our idea is to integrate findings of former research as single steps into a digital study assistant. These steps should be student-initialized and have durations of minutes or less. This is a new approach, different to time-consuming conventional goal setting interventions. For example the following use cases may appear:

- When students begin to use the assistant, it asks them to define inspiring study goals for the future.
- If students have difficulties to define goals, the study assistant proposes them to elaborate on or think about their ideal future, qualities admired in others, things to do better, their career in the future, things to learn and habits to improve. This may inspire them to access or create their individual goals.
- When a goal has been created by a student, the assistant proposes the student to elaborate on or think about positive impacts if the goal is reached. This may increase commitment to and subjective importance of a specific goal.
- When a goal has been created by a student, the assistant proposes the student to identify potential obstacles and how to overcome them on the way towards the goal. This may direct attention and efforts towards goals and foster strategies and behaviors for goal achievement.
- When students have defined inspiring distal goals, the study assistant may propose to split the goals into sub-goals and sub-sub-goals until S.M.A.R.T. goals or actions are derived. This feature may be realized as a tree-shaped

visualization we will call goal trees. This feature may increase motivation and activity as proximal goals become meaningful by the connection to inspiring distal goals while distal goals become tractable.

- When students define actions, the assistant may ask them to allocate time and define due-dates and to allocate additional required resources.
- When students have defined actions with due-dates, they can configure the assistant to send them reminders.
- When goal trees have been defined, the assistant may regularly remind the student to review the goal tree, monitor goal achievement, evaluate success and if necessary create new sub-goals and actions. This process implements self-regulation.
- When goals are defined by students, the assistant may ask for benchmarks of success. These may form a foundation for self-monitoring.
- When a student has defined goals which are quantifiable, such as learning times or grades, the study assistance software provides feedback about the degree of goal achievement. Such feedback may, according to former research, increase performance.
- When a student defines goals, those can be negotiated between student and assistant in a dialogue or questions by the assistant, such that task-difficulty is maximal but still under the threshold of excessive demands. This will, according to former research, maximize learning performance.
- Public commitment in form of sharing goals with other users of the assistant may increase goal commitment and as a consequence raise performance.

3.2 Evaluation procedure

The effects of the assistant will be evaluated in a between-groups design with pre- and post- measurements. The duration will be one semester so that the assistant usage has enough time to show its effects. Participants will be assigned to three groups:

- One group will use a study assistant with goal setting features.
- A second group will use a study assistant without goal setting features.
- A third group, the control group, will not use a study assistant at all.

Dependent variables that will be assessed in pre- and post- measurements are self-efficacy, affect, General Point Average and additionally the ability to structure goals, measured by a self-constructed instrument which will be developed as part of this research.

The resulting data will be analyzed with an analysis of variance with group conditions as first factor and time as second factor. Possibly confounding variables, such as age, semester, and gender will be recorded by a questionnaire.

The resulting goal trees, their changes over time and the goals formulated in natural language will be used for exploratory data analysis.

3.4 Time Plan

The winter term 2020/2021 will be used for data-acquisition. Before this can happen, the assistant has to be designed, implemented and tested in collaboration with the SIDDATA project team. Also an instrument suitable to measure the ability to structure goals has to be developed and instruments suitable for the measurement of self-efficacy and affect have to be chosen for pre- and post-measurements. Participants have to be recruited. Data may be ready for analysis in April 2021.

The writing process will run parallel to the project and may be completed after data analysis, interpretation and discussion. A first draft will be handed to the supervisor for formative feedback, a second draft for summative feedback and then a final version will be handed in. In between partial results may published. The goal is to be hand in the final version in April 2022.

4 Conclusions

Concludingly it may be said that there is a broad theoretical foundation as a basis for the implementation of our digital data-driven study-assistant. A lot of work will have to be done to implement the study assistant, develop an instrument capable to measure goal setting abilities, acquire data and analyse it.

It remains to be shown how the theoretical findings can be applied in our study assistant and whether the findings from Morisano do generalize to non-struggling students. Another challenge will be to empower the students to develop abilities and skills and not to outsource abilities to the assistant.

If we are successful in implementing a practical application of the theoretical knowledge outlined in this research proposal, the result may be a study assistant which has the potential to improve self-efficacy well-being and study-success of many students and provide them with valuable skills not only for their studies but also for life.

5 References

- [Band91] Bandura, Albert: Social cognitive theory of self-regulation. In: *Organizational Behavior and Human Decision Processes* Bd. 50 (1991), Nr. 2, S. 248–287. s— ISBN 0749-5978

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- [Dora81] Doran, George T.: There's a S.M.A.R.T way to write management's goals and objectives. In: *Management Review* Bd. 70 (1981), Nr. 11, S. 35–36. — ISBN 0025-1895
- [EhKe19] Ehlers, Ulf-Daniel ; Kellermann, Sarah A.: *Future Skills - The future of learning and higher education*. Karlsruhe, 2019
- [Erez77] Erez, Miriam: Feedback: A Necessary Condition for the Goal Setting-Performance Relationship. In: *Journal of Applied Psychology* Bd. 62 (1977), Nr. 5, S. 624–627
- [Lath91] Latham, Gary P., Locke, Edwin A.: Self-Regulation through Goal Setting. In: *Organizational Behavior and Human Decision Processes* Bd. 50 (1991), S. 212–247. — Locke & Latham
- [LoLa02] Locke, Edwin A. ; Latham, Gary P.: Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. In: *American Psychologist* Bd. 57 (2002), Nr. 9, S. 705–717. — ISBN 1935-990X (Electronic); 0003-066X (Print)
- [LoLa90] Locke, Edwin A. ; Latham, Gary P.: *A theory of goal setting and task performance*. Englewood Cliffs, NJ, USA : Prentice Hall, 1990
- [MHPP10] Morisano, Dominique ; Hirsh, Jacob B. ; Peterson, Jordan B. ; Pihl, Robert O. ; Shore, Bruce M.: Setting, elaborating, and reflecting on personal goals improves academic performance. In: *Journal of Applied Psychology* Bd. 95 (2010), Nr. 2, S. 255–264
- [OsTh18] Osada, Sebastian ; Thelen, Tobias: *SIDDATA - Joint project for Individualization of Studies through Digital, Data-Driven Assistants*. URL <https://www.siddata.de/en/>
- [StKr07] Storch, Maja ; Krause, Frank: *Selbstmanagement - ressourcenorientiert. Grundlagen und Trainingsmanual für die Arbeit mit dem Zürcher Ressourcen Modell (ZRM)*, 2007 — ISBN 978-3-456-84444-2r3-456-84444-1