

Supporting students to study smart

Citation for published version (APA):

Biwer, F. (2022). *Supporting students to study smart: a learning sciences perspective*. [Doctoral Thesis, Maastricht University]. Ridderprint. <https://doi.org/10.26481/dis.20220708fb>

Document status and date:

Published: 01/01/2022

DOI:

[10.26481/dis.20220708fb](https://doi.org/10.26481/dis.20220708fb)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
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RESEARCH SUMMARY

When entering university, many students feel overwhelmed with the amount of information they need to learn and the freedom they get in doing so. Teaching students how to learn is important. This equips them with the skills to acquire and retain new knowledge and regulate their learning more effectively and sustainably. One specific challenge in teaching students how to regulate their learning is that students' perceptions about what works best often deviates from what actually helps learning. Research has repeatedly shown that students learn best with strategies that produce so-called 'desirable difficulties' (Bjork & Bjork, 2020). Desirably difficult learning strategies initially require more effort (for example, it is more effortful to test yourself than to reread learning material), but they provide a greater learning benefit in the long term. However, many students do not know which strategies are actually effective for long-term learning, and why. Even if they do, they often avoid using them because of the additional effort it takes. Instead, students often feel that they would learn more with passive strategies, such as rereading or highlighting. Therefore, this dissertation aimed to examine how we can support students to use more effective, desirably difficult, learning strategies during their self-study.

We developed the 'Study Smart program', a direct training for students that focuses on awareness about, practice with, and reflection on desirably difficult learning strategies. Students who attended the training gained more accurate knowledge about which strategies are effective and why, and they reported using more active and effective learning strategies, such as quizzing. Students also reported struggling to sustainably implement these effective strategies during self-study. They mentioned being uncertain about how to apply the strategies in their own context, for instance. Thus, they easily fell back into old ineffective study habits and reported the lack of external support, as in no available practice questions, as one major challenge. With regard to the latter, we investigated whether students could benefit from answering their self-generated questions, in case no practice questions were provided. We conducted two experiments to assess the benefit of answering self-generated questions compared to answering provided questions or

restudying and found that answering self-generated questions offered no benefit compared to restudying the text. Rereading a text once and then answering provided questions with feedback appeared to be the most effective strategy. These findings stress the importance of providing students with more external support, as in more guidance on how to make good practice questions or providing a database of relevant practice questions.

Besides this example of how to support students' practice of one specific learning strategy (retrieval practice), we also investigated the effects of the Study Smart training when implemented in different contexts and on larger scale. We found that attending the training in combination with regular follow-up support can help lower-achieving students to improve their grades over the course of their first year, compared to students from an earlier cohort that did not receive the training. When implementing a learning strategy training on a larger scale, we recommend - based on our findings - to provide the training to all students as early as possible. Ideally, the training is embedded in the context of the curriculum, which enables teachers to apply the principles of active learning and desirable difficulties in their teaching.

Furthermore, we investigated how students adapted to remote learning during the COVID-19 pandemic. We found that students differed in their ability to adapt to online learning: some students struggled to concentrate and manage their time or energy effectively (the 'overwhelmed' and 'surrenderers'). Other students just maintained their level from before the crisis (the 'maintainers') or succeeded to effectively manage their energy, keep up attention and studied successfully online (the 'adapters'). With this last study, we contributed to a better understanding of the challenges students experienced in managing and regulating their resources in online learning.

SCIENTIFIC IMPACT

The research conducted in this dissertation sets an example of how to investigate the effect of an evidence-based learning strategy training that focuses on desirable difficulties. Our findings add to previous research on self-regulated learning by

demonstrating the importance of combining theory-based methods (i.e., direct instruction on the effectiveness of different learning strategies) with experience-based methods (i.e., letting students experience the benefits of different strategies), and supporting practice (i.e., guiding students in their practice with learning strategies). Future research can progress by investigating the best balance between theory- and experience-based methods to convince students about the effectiveness of desirably difficult learning strategies and to support students implementing these strategies during self-study. Furthermore, the Study Smart program has been shown to be an important first step in teaching students self-regulated learning skills. A next step is to examine how training of self-regulation skills can be integrated in the complexity of real-life higher education practice. For instance, by developing a course framework that incorporates professional development of teachers, enabling them to support their students' self-regulation skills.

The COVID-19 years have demonstrated the importance of the ability to adapt to a fast-changing world. When students were forced to study online, with less resources and support than they were used to, the importance of successful self-regulation of learning became even more evident. We showed that students differed greatly in their ability to regulate their resources (e.g., motivation, effort, attention, time) and to adapt to online learning. Our approach highlights the individual differences in self-regulated learning skills, which in turn provides a more nuanced interpretation of the data (Kusurkar et al., 2020). Future research could provide knowledge on how to deal with this heterogeneity. This could facilitate the development of more personalized interventions and customized support for students who experience different challenges in adapting to changing contexts, such as online learning.

In this dissertation, we combined different methods and perspectives, from an educational design research perspective to a cognitive psychology perspective. We combined different types of data: qualitative data from focus groups and observations and quantitative data from evaluations and self-report measures. Lastly, we combined surveys and controlled experiments. This variety of methods and perspectives demonstrates the challenges but also the richness of research in the learning sciences: to understand the working ingredients of a training on

the one hand, and to bridge basic experimental and applied classroom research on the other.

SOCIAL IMPACT

This project contributes to the Maastricht University quality agreements on supporting student success and assisting students in acquiring skills to ‘maintain a healthy study-life balance, stimulating a habit of personal responsibility and lifelong learning’. The insights gained from the research studies presented in chapters 2, 3, and 4 have been directly implemented in the mentor programs of different faculties at this university. As a result, students starting at Maastricht University are now taught how to study more effectively with the Study Smart program. In the future, Study Smart will be continued through a Maastricht University central project on student success and integrated with research on student advising.

The Study Smart program is also implemented in other higher education institutions in The Netherlands and abroad, and receives national and international attention and interest. It has been implemented, for example, in the Pharmacology program at Utrecht University and the University of Chapel Hill (United States), and in the Biomedical Sciences program at the University of Aveiro (Portugal). Other institutions that are interested in offering the program to their students and adapting it to their own needs and context can find more information on the website www.studysmartpbl.com.

TARGET GROUPS THAT CAN BENEFIT FROM THIS RESEARCH

Our first and foremost target group are all students in higher education, at different levels (research universities, universities of applied science) and in different study programs whom we reach by training their mentors, student counsellors, and teachers. The Study Smart program aims to make students more aware of their own learning strategies and to teach them about effective strategies for long-term learning, to support their practice of these learning strategies and to stimulate

reflection on study motivation and self-regulated strategy use. We aim to teach students how to study more effectively for the long term and to enable them to become life-long learners.

Second, our findings are especially relevant for teachers, mentors and student counsellors, who can find guidelines on how to support students in studying more effectively. Support in self-regulated learning is a common topic in mentor-student meetings. However, in many study programs, mentors do not necessarily have a background on learning sciences, although they are usually experienced staff members. The Study Smart program can offer useful guidelines on how to start and continue a discussion on self-regulated learning skills with their students, and support them individually in developing an effective strategy, using findings that are based on empirical evidence.

Third, educational and curriculum designers, including course coordinators and program directors, can apply our findings in educational practice. They should facilitate the provision of practice exams and questions, and build an organizational support system for their teachers. Higher education organizations can contribute to create a study and learning environment that enables students to use effective learning strategies in an authentic context.

Fourth, educational researchers and designers could use our findings to develop a study strategy training adapted to their own context and target group.

SCIENTIFIC AND SOCIETAL ACTIVITIES

Our results would not have an impact had they not been presented or shared with others openly and regularly. Studies included in this dissertation can be accessed via published open-access manuscripts (Chapters 2, 4, 6) or are intended to be published in the near future (Chapters 3, 5) in open-access scientific journals that address a broad audience in the field of educational and cognitive psychology as well as medical and health sciences education.

All studies were presented as research paper, workshop, symposium or poster presentation at national and international scientific conferences: at the European Research Association for Learning and Instruction (EARLI) in 2019 and 2021, the

Junior researchers network of EARLI (JURE) in 2018 and 2019, the Special Interest Group for Metacognition (SIG 16) in 2018 and 2020, the International Cognitive Load Theory Conference (ICLTC) in 2019 and 2021, the American Educational Research Association Annual Meeting (AERA) in 2020, the Dutch Education Days (ORD) in 2019 and 2020, the annual meeting of the international association for medical education (AMEE) in 2019, and the annual meeting of the Dutch Association for Medical Education (NVMO) in 2019 and 2020.

In addition, I presented our findings to research colleagues during the ICO (Interuniversity center for educational sciences) conferences, the School of Health Professions Education (SHE) academies in 2018, 2019, and 2021 and other departmental meetings, such as lunch lectures in 2018 and 2020 and the Research Meet at EDLAB, the Maastricht University Institute for Educational Innovation. Moreover, I presented our research findings and implications to students in regular lectures during the well-being week at Maastricht University, or at external institutes, such as Binus University in Indonesia. I also guided a discussion about effective learning during a ‘Student Meet’ at EDLAB. In the last year of my PhD project, I was selected as one of 12 ‘Faces of Science’ of the KNAW (the Royal Dutch Association of Science). I got the possibility to share my insights and views on science in general and on current topics of the learning sciences, as well as my thoughts on educational themes in blog-posts for young students (<https://www.nemokennislink.nl/facesofscience/wetenschappers/felicitas-biwer/>).

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