Structured Digital Writing Lab

Workflow, Application and Evaluation

https://doi.org/10.3991/ijoe.v18i14.35075

Dieter Uckelmann[1(✉)], Sven Judel[2], Sergej Görzen[2], Christoph Greven[2], Ulrik Schroeder[2]
[1]University of Applied Science Stuttgart, Stuttgart, Germany
[2]RWTH Aachen University, Aachen, Germany
dieter.uckelmann@hft-stuttgart.de

Abstract—The importance of writing and publishing is well understood in the academic world and is gaining importance in business applications as well. Students need to gain corresponding skills during their studies. The process itself can be structured and is repeatable. However, students are not familiar with the process and need some guidance to achieve high quality results. Typical writing seminars may be quite theoretical and do not sufficiently guide the writing in teams, reviewing and publication process. This paper presents the Scientific Workflow Guide SWOFI that can be used to guide collaborative academic writing and publishing in a structured process, which resembles the guided process in lab-based education. The results which have been achieved in different seminars at two different institutions are analyzed and discussed.

Keywords—scientific writing, lab-based education, collaborative writing, peer reviews in education, digital guidance

1 Introduction

Writing skills can be achieved by learning and training processes and to attain these skills, students should have the opportunity to train continually with expert guidance [1]. This raises the didactical question of how to motivate students to train these different skills for business and academic purposes. How do we train critical reading and questioning of written material? How do we teach them to analyze a specific new topic on their own and create a valuable written output based on their findings? And last not least – how do we empower students to be fit for a further academic or business career?

According to Kruse [2], *"Teaching the writing process is probably the most important domain for writing teachers"*. He claims that *"Writers should learn the steps in which writing proceeds, the recursive nature of writing, the actions of planning, idea generation, and revision"*. However, a digital tool to support the structured and guided writing and improvement process is missing. Instead, writings are most often only graded and do not lead to an improvement of the writing process skills.

1.1 Existing approaches to guiding academic writing seminars

This paper focusses on academic writing in higher education as part of a seminar. One approach to guide academic writing are so called *writing labs*, which may be centralized institutional centers (see, e.g. Purdue Writing Lab, HSG Writing Lab), or decentralized approaches in individual seminars. The centralized lab approach may be described as *"A place, often situated on an educational campus, where individuals can go to receive one-on-one tutoring about their writing"* [3]. A definition for a decentralized lab approach is missing. Corresponding software tools enable lecturers to provide structured guidance to academic writing in their lectures without the need for institutional support. Additionally, a decentralized approach enables more flexibility in adjusting the corresponding tool to the individual needs and concepts of the seminar. We therefore consider this lab approach to be *"brought to the real or virtual lecture room, individually adjusted to seminar needs and utilized by lecturers"*.

There are numerous scientific publications on writing labs. A corresponding search on Google Scholar provides 3.120 findings in all and 1.330 findings for the last ten years (2012–2022). The goal of our literature search was to filter and identify publications which are addressing digital tools to guide a structured workflow in decentralized writing labs. Google scholar has been chosen for the search, as it is freely accessible and commercial offerings such as Scopus are not available for research for all universities. Search options "include patents" and "include citations" were deactivated. The search was last performed on July 14th, 2022. Search 3 was used as the basis for further analysis (Table 1).

Table 1. Search term combinations and filters used for literature research on writing labs

	Search Term 1	Search Term 2	Logical Operator	Filters	No. of Findings
Search 1	writing labs	–	–		3.120
Search 2	writing labs	–	–	2012–2022	1.330
Search 3	**writing labs**	**workflow**	**AND**	**2012–2022**	**31**

Unfortunately, a search on Google Scholar brings up numerous non-relevant results. Most identified publications were eliminated from the search as they were

- not freely available,
- not peer-reviewed,
- not available in English or German,
- focused on teaching English as a language instead of scientific writing,
- not focusing on writing lab workflows but using these terms only in relation to other research foci.

One publication focused on developing web-applications for writing centers [4], another mentioned a basic five-stage writing process "*planning, drafting, revising, editing, and publishing"* [5]. However, the authors do not mention research nor peer review phases. A flexible tool to structure and guide the academic writing workflow according

to the individual didactical needs of university professors lecturing writing seminars thus seems to be missing.

On the other hand, there are numerous online tools available for collaborative writing, such as Google docs (privacy concerns), GitBook (no scientific reference integration), Overleaf (Tex-based and thus requiring a steep learning curve outside the field of computer science), MediaWiki, Sharepoint, Confluence (pricey), and Dropbox (privacy concerns). These tools may support scientific tasks but do not focus on the overall scientific writing workflow. A different approach for structuring and supervising the writing and review process is needed.

The paper is structured as follows. Section 2 describes the concept and technical considerations of the Scientific Workflow Guide (SWOFI) that should guide students through writing labs. Sections 3 and 4 describe how this tool is used at RWTH Aachen und HFT Stuttgart while section 5 presents students' responses on the tool. Section 6 presents the next steps of using and improving SWOFI and concludes the paper.

2 Scientific Workflow Guide – SWOFI

A first approach of creating a workflow guide considered using and adjusting a Learning Management System (LMS). Unfortunately, modular LMS like Moodle depend on the availability of suitable plugins to provide all necessary features. If they are not given, resources to develop and maintain them continuously are required. Therefore, the **S**cientific **W**ork**f**low Gu**i**de (SWOFI[1]) has been developed as a standalone tool to address these needs. SWOFI enables the individual configuration of a process according to the needs of a course, writing lab or workflow without the need for an LMS and further plugins.

To fulfill the need of modelling the designed process for (pro-)seminars (see Sections 3 and 4), processes can consist of multiple phases which include smaller steps. SWOFI supports students continuously during the semester. It offers an overview of the whole writing process for better understanding and aims to support situated learning and application. Each step can have a deadline with a specific duration or a fixated date.

SWOFI is split into two big software systems and some smaller subsystems. The first big system is a web panel for lecturers, where they can customize and conduct new process instances based on existing ones, predefined public templates or building them from scratch. The lecturers can review students' submissions and adjust deadlines or peer review regulations. The other web panel is for students. It is designed to visualize the process phase by phase, step by step (see Figure 1).

[1] https://swofi.net

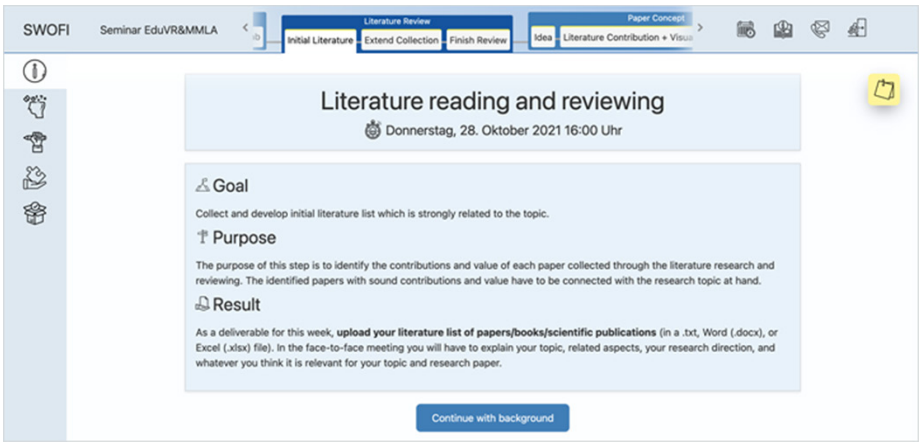

Fig. 1. SWOFI web interface for students

By visualizing the complete process, the students are provided an overview and guidance to prevent them feeling lost or overwhelmed. For each step, the goal and purpose are defined to motivate the students by seeing how their work will affect the final paper. Additionally, a task description, recommended external links and relevant subsystems can be provided. To keep track on the submissions, a dedicated overview on the deadlines is included and shown in Figure 2.

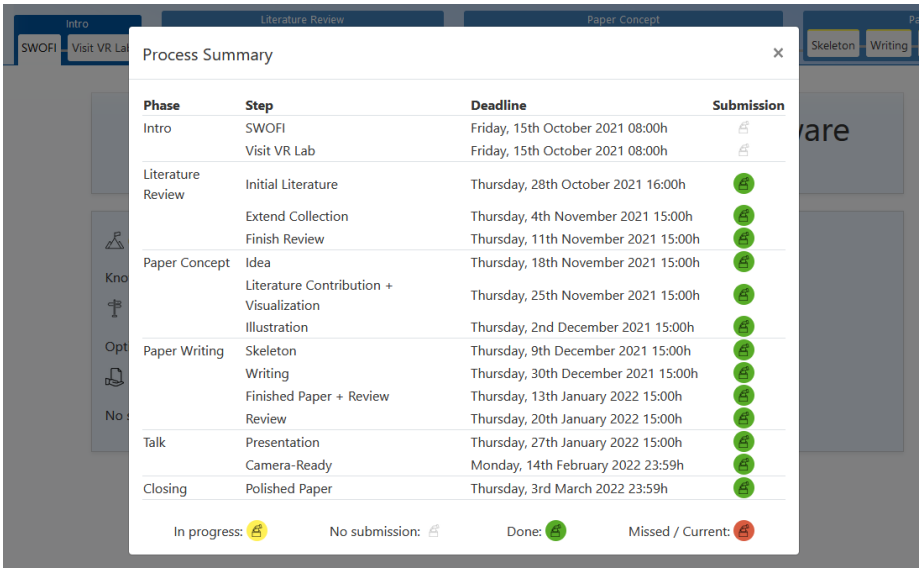

Fig. 2. SWOFI web interface for students

One of the subsystems of SWOFI enables peer review procedures of submitted students work (see Figure 3 left). Next to a PDF preview, a customizable review sheet helps students to provide valuable feedback to each other. A criteria sheet can define required feedback on different aspects of the paper like the structure, the language, or the contribution to the research community. Further subsystems support the creation of researcher community maps and the collection of literature to support the learning progress how to work with literature and researcher communities. The literature lists (example given in Figure 3 right) are shareable and support live updates to enable collaborative work. Additionally, a paper outline can be created and the collected literature inserted at the intended place.

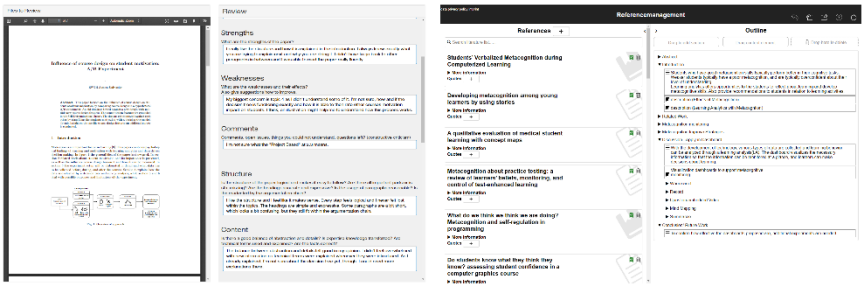

Fig. 3. Two of SWOFIs subsystems, the peer review on the left, the reference management on the right

The enrollment for a process is done via mail, including an invitation code. On a similar way, students can form groups (if allowed by the process) themselves. Supervisors can define time slots for personal meetings (bound to their Outlook calendar) that students can book with one mouse click. All these features should lower barriers and help students to focus on the actual scientific progress.

Although the idea of creating SWOFI lays within the conduction of writing labs and the related processes, the whole system was implemented in a way that allows arbitrary processes to be modelled and supported.

3 Seminars and proseminars in computer science at RWTH Aachen

In the computer science bachelor program at RWTH Aachen University, two modules are given in which students should learn and train scientific work to prepare themselves for writing the bachelor thesis. The first module, the *Introduction to Scientific Work* (*Proseminar*), focuses on methodology on how to find and evaluate scientific papers, gain new knowledge and communicate it in a written report as well as an oral presentation. The content of the research and report is subsequent and just slightly connected to the research area of the offering chair or research group. To participate in the second module, the seminar, students are required to have passed a proseminar. This should ensure that students have gained the skills of scientific work such that seminars can focus more on content.

3.1 Inconsistent course design and learning outcomes

Each semester, different courses for these proseminars and seminars are offered by the computer science department's chairs and research groups such that students can apply for courses that deal with topics they are interested in. Observations, like presented in [6], of these courses have shown quality deficiencies in the results of the courses and thus possibly bad influence in later study progress. When students have less guidance, missing process understanding, no individual supervising, or have difficulties to reflect information critically, it leads to high dropout rates and results in bad quality submissions [6]. Additional studies also point out different issues within writing classes that needs to be faced and overcome [7].

3.2 Identifying core competencies and providing work process

To overcome the issue of missing skills and competencies, a standardized core process of scientific work in computer science was defined. It consists of the three key competencies

– information research,
– added value creation and
– information communication.

Information research includes the skills of formulating good search queries, reading literature effectively and efficiently as well as deciding what is relevant towards the own work. The creation of added value refers to identifying research gaps and providing new insights or ideas for the research community. Information communication includes both a written report as well as the creation of presentation slides and giving a talk.

These competencies are distributed over 5 phases that are shown in Figure 4. Literature research and focus aim at information gathering and filtering to come up with a collection of related work for the own paper. This process starts by gaining knowledge of the research domain, the (pro-)seminar is dealing with. After that, more specific knowledge is gathered about the assigned topic, a student should write a paper about. These references should also be enriched with State-of-the-Art paper and be used to identify research gaps. With these insights, students should set their own focus and generate added value. The own findings should be written down in a report. To also train feedback competencies of students, the written reports are reviewed in a peer review process. Finally, a talk should be prepared and given.

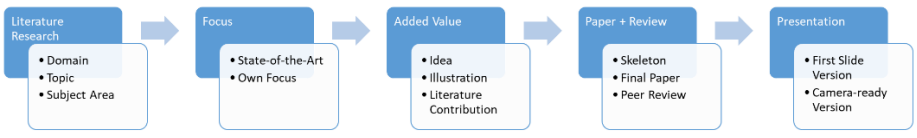

Fig. 4. Sample proseminar process

The whole process is communicated to the students from the very beginning. They should know what to do and how each step impacts the final report and presentation and therefore their grade. To communicate the process and provide support for each step, SWOFI is used.

4 Seminar HFT Stuttgart

Within a seminar of the master program "Environmental Logistics" students are asked to write a scientific publication on given topics related to logistics, including technical and/or environmental subjects. The lecture follows a lab-based approach (DigiLabTC) since 2020 [8], which has been developed during a research project for networked university lab infrastructures. Therefore, the name for this seminar concept has been changed from "Writing Factory" [9] to "Writing Lab". Additionally, as students practice writing and reviewing in a more controlled environment in comparison to usual scientific writing and submission processes, the term "Lab" seems more appropriate. As shown in paragraph 1.1, usage of the term "Writing Lab" is scientifically established.

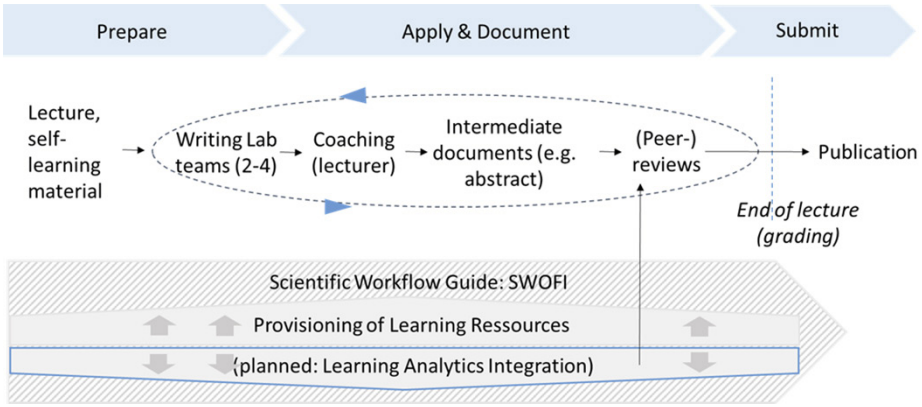

Fig. 5. Writing lab structure based on DigiLabTC

The original concept of DigiLabTC has been adjusted to the Writing Lab. The structure in Figure 5 has been used for the seminar.

During the preparation phase, an introduction to the "Writing Lab" and research-/output-oriented learning (requiring an informative output to a third party) as well as to cooperative writing is provided in a lecture format. Links to published publications of prior seminars are provided. The grading scheme is shown, so that students know what to focus on from the beginning. Possible writing topics related to technology usage in logistics are presented. Every year, new, current, interesting and motivating topics are provided. Student groups can name alternative topics but have to ensure that these topics have not been addressed in other lectures or seminars. Students are free to build

groups of 2 to 4 students, based on the chosen methodology. If the paper will be based on a literature review, only 2 students are allowed in a group. If additional interviews or pilot applications are planned, groups can be bigger. Student groups can select and rank three topics (T1–T3). Topics are assigned by the lecturer based on the ranking and collisions with other groups. A test peer-review on a publication from last year is requested in order to teach the review process, which is new to most students. The benefits of teaching peer-reviews have already been shown by Guilford in 2001 [10] and Sun in 2020 [11]. Through this early review, students know better what is expected from them and what to look out for in their own writing. Other topics which are discussed during the preparation phase are paper concept development, targeting of a journal, splitting of work topics and author sequence listing discussion. Students split their work items in different topics and know and accept their own work tasks. Possible journals (or conferences in rare cases) are chosen for submission. Author guidelines and submission dates are investigated by each group.

While in classical lab-experiments, the lab testing (qualification skill: "apply") and documentation (qualification skill: "document") usually are two separate processes, these are not easy to distinguish in a Writing Lab, thus we consider an integrated application and documentation phase. During the application phase, student groups need to upload and/or present intermediate results such as an abstract and a literature review which are discussed in feedback sessions with the lecturer. The main focus, however, is on iterative writing sprints. In non-Corona times, tables were rearranged in the lecture room to allow the groups to sit together in a close environment. Quiet writing sessions of up to 90 minutes were followed by short discussion rounds in the groups. The quiet atmosphere during the writing session fostered concentration on the topic and showed a very motivating element for all group members to write in parallel. The missing writing sprints during the first "Corona" summer-term 2020 has been the main problem of the lecture. The online meeting tool used in 2020 (GoToMeeting) did not provide breakout rooms. During the summer-term of 2021, a different tool (Zoom) providing breakout-sessions has been used. The usability of breakout-sessions for writing sprints was very high, as lecturers could hop easily between the groups to provide feedback. In 2022, face-to-face sprint sessions were used to support a "factory/shop-floor paper production experience". However, looking back, the online breakout sessions seemed more productive, even though this hasn't been thoroughly investigated. Part of the application phase are the peer-reviews. Students are uploading their papers and perform peer-reviews. Every student has to review two to three papers. The review results have to be addressed by the authors for the final iteration of their paper.

The submission phase may be longer than the lecture period. The final papers are uploaded to SWOFI. Besides writing the papers students have to present their work to their peers, similar to a scientific conference. In a following meeting with the lecturer, students are asked to evaluate their own work and suggest their own grade. Their proposals are compared to the supervisor grades and discussed. Up to now, about 80% of the student expectations were met by the supervisor grades. The remaining 20% needed to be discussed and could lead to adjustments of the grades – in both directions. Submission to a journal requires prior approval by the lecturer. While the main focus in SWOFI is on structuring and guiding the writing workflow, it also provides an easy way to monitor intermediate and final uploads. At HFT Stuttgart, all final material

including a Word-textfile, a PDF and separate graphic-files need to be uploaded to SWOFI in advance of any journal submission to ensure that time-critical small changes requested by the journals can be done by the supervisor if students are e.g. on vacation. Submissions are sent via mail to the journals and supervisors are in CC. Most of the papers are submitted after the end of the summer term. External reviews may still lead to follow-up work. In the last years there has not been one single problem in providing the necessary changes as the students were quite committed to their work. Some submissions have been rejected in the past, especially if students are targeting higher ranked conferences and journals.

In Table 2, the findings of the last five years are analysed and the advantages and challenges are discussed. Important evaluation measures are the number of submissions and publications each year.

Table 2. Measures of the years 2018–2022 (2022 submission results are preliminary)

Year	Tool Used	Students	Groups	Submissions	Publications	Evaluations	Effort
2018	EasyChair	22	10	7	6	9	2.4
2019	EasyChair	21	9	7	5	14	2.7
2020	SWOFI	17	8	6	4	8	1.9
2021	SWOFI	26	12	5	4	16	2.2
2022	SWOFI	24	11	>=4	?	11	2.8

The results so far have been very good. Achieving between 4 and 6 publications out of 8 to 12 groups shows a good output-ratio. However, not all groups were able to write a publishable paper.

The workload has predominantly been estimated as too high by the students. The students were asked if the time needed to achieve the credit points (each credit point relates to 30h of work) appropriate, with criteria ranging from "way too high" (1) to "way too low" (5). The results were as follows – 2018: 2.4, 2019: 2.7, 2020: 1.9, 2021: 2.2, 2022: 2.8 – where 3 would be the optimum fit and everything lower indicates a higher workload. In 2018/2019, before SWOFI was available, EasyChair has been used as a tool to guide the review process. Interestingly, the workload was rated highest when SWOFI was introduced in 2020, and improved again in 2021 and even more in 2022. It seems that students and lecturers have gotten used to using digital tools during the Corona-crisis. Additionally, the workflow within SWOFI was improved over time, based on the feedback from students. For example, there have been some discrepancies between the lecture slides, the text in SWOFI and the upload time settings in 2020, which were reduced in 2021.

5 Feedback on SWOFI

At RWTH Aachen University and HFT Stuttgart, SWOFI was used in 15 proseminars and 19 seminars. In the course evaluation, many positive comments were given about SWOFI:

- C1, 2020: *"SWOFI as a tool for information on the tasks was helpful (i.e., the structure etc.)"*.
- C2, 2020: *"SWOFI was good, because it was always easy to find things and to look up things again"*.
- C3, 2021: *"Working with SWOFI has made the time planning of the article creation very easy— > very good tool"*.
- C4, 2021: *"The processing of the task (seminar paper) is very well structured through SWOFI. You always know what the current task is and you don't lose and thus does not lose the overview. I like the SWOFI programme very much"*.
- C5, 2022: *"The seminar was well structured and accompanied the writing process in parallel"*.
- C6, 2022: *"Through SWOFI, the schedule and the current tasks are always transparent"*.
- *C7, 2022: "SWOFI provided a clear structure"*.
- *C8, 2022: "Always having a deadline helps to be always on track and do what you need to do"*.

As negative comments at HFT Stuttgart, some students mentioned that SWOFI as an additional digital platform (besides Moodle) is causing extra work and attention. Such responses were not present at RWTH Aachen as SWOFI was the only tool used in the courses. Some students wished reminder push-messages in SWOFI.

Now that the SWOFI workflows have been set up, they can be copied and reused for the following years. However, in the case of the Writing Lab at HFT Stuttgart, the dates for submissions and lectures need to be changed in the database and in the accompanying text, which has led to errors in the past. Therefore, it would be helpful if data fields could be linked in the text. The workload on the lecturer is still high, as numerous intermediate reviews are needed. An interesting field of research will be to integrate Learning Analytics (LA) and Artificial Intelligence (AI) for more automated feedback functions during the process.

6 Conclusion, adaptability and future work

The acceptance of SWOFI has been very positive from student as well as from lecturer side. The usability has been proven in different seminars and in different institutions. However, we see a huge change in adapting SWOFI for further seminars on different qualification levels (Table 3).

Table 3. Additional workflow optimization potentials in writing seminars on different qualification levels

EQF	Additional Writing Exercise Opportunities	
	Opportunities	***Lecture / Publication Examples***
EQF 6 (Bachelor)	Seminar, lab and project reports (individual or groups)	e.g. in a multi-term interdisciplinary student projects (see e.g. [12]), computer science proseminar (see e.g. [6])
	Internship reports (individual)	e.g. in some bachelor's degrees at HFT Stuttgart reports are mandatory
	Bachelor's theses (individual)	e.g. in anthologies made up of student papers based on their thesis topics (see e.g. [13])
EQF 7 (Master)	Seminar, lab and project reports (individual or groups)	e.g. in a multi-term interdisciplinary student projects (see e.g. [12]), computer science seminar
	Master's theses (individual)	e.g. in anthologies made up of student papers based on their thesis topics (see e.g. [13])
	Business plan (individual)	e.g. in a module on "Planning, Organization, Management"; Master "Photogrammetry" at HFT Stuttgart
	Short scientific publication submitted to a journal or conference with low acceptance criteria (groups)	e.g. Writing Lab, Seminar in Master "Environmental Logistics"
	Short research proposals (groups)	e.g. Seminar in Master "SENCE" at HFT Stuttgart
EQF 8 (PhD)	Scientific publications to peer-reviewed conferences and journals (groups)	PhD seminars PhD Writing Lab at HFT Stuttgart (ongoing) PhD-seminar at the University of Parma on a thesis-related topic (ongoing)
	Research proposals (groups)	
	Learning chapters	

The next steps are to utilize SWOFI in more (pro-)seminars at RWTH Aachen and HFT Stuttgart. This would allow to harmonize the teaching of the core writing competencies within seminars. One option is to include and to extend the usage of SWOFI and the designed processes for scientific work of PhD-students.

The wider usage of SWOFI will provide more insights in the efficiency as well as issues of the tool and its processes. Through interviews with seminar organizers of different institutes, (hard) requirements to SWOFI e.g., individual deadlines and further requirements to literature research, were collected. These requirements will be considered in the next development iterations of SWOFI. Even though the presented approach is a first stable solution, the lecturer web interface has space for improvements. Improving the usability could increase the trust in the system and allows a better organization of the running courses.

Including automated feedback is another interesting field to be explored here. Currently, all reviews are done by peers of supervisors. Already existing approaches in this manner like presented in [14] will be evaluated in the future.

7 References

[1] F. Paas and J. Sweller, "An Evolutionary Upgrade of Cognitive Load Theory: Using the Human Motor System and Collaboration to Support the Learning of Complex Cognitive Tasks", *Educ. Psychol. Rev.*, vol. 24, no. 1, pp. 27–45, 2011. https://doi.org/10.1007/s10648-011-9179-2

[2] O. Kruse, "Perspectives on Academic Writing in European Higher Education: Genres, Practices and Competences", *REDU: Revista de Docencia Universitaria*, vol. 11, no. 1, pp. 37–58, 2013.

[3] D. L. Driscoll, H. A. Brizee, M. Salvo, and M. Sousa, "Usability and User-Centered Theory for 21st Century OWLs", in: Handbook of Research on Virtual Workplaces and the New Nature of Business Practices, IGI Global, pp. 614–631, 2008. https://doi.org/10.4018/978-1-59904-893-2.ch045

[4] A. Petit, "Designing Web-Based Applications for 21st Century Writing Classrooms", *IEEE Transactions on Professional Communication*, vol. 57, no. 3, pp. 235–237, 2014. https://doi.org/10.1109/TPC.2014.2342337

[5] K. W. Lee, N. Said, and C. K. Tan, "Exploring the Affordances of The Writing Portal (TWP) as an Online Supplementary Writing Platform", *Computer Assisted Language Learning*, vol. 29, no. 6, pp. 1116–1135, 2016. https://doi.org/10.1080/09588221.2016.1172644

[6] Ch. Greven, and U. Schroeder, "Wissenschaftliches Arbeiten lernen: Eine Problemanalyse", in: Hochschuldidaktik der Informatik HDI 2018 : 8. Fachtagung des GI-Fachbereichs Informatik und Ausbildung/Didaktik der Informatik : 12–13. September 2018, Goethe-Universität Frankfurt am Main / Nadine Bergner, René Röpke, Ulrik Schroeder, Detlef Krömker (Eds.), pp. 152–161, 2018.

[7] D. Ramadhanti, A. S. Ghazali, M. Hasanah, and T. Harsiati, "Students' Metacognitive Weaknesses in Academic Writing: A Preliminary Research", *Int. J. Emerg. Technol. Learn.*, vol. 14, no. 11, pp. 41–57, Jun. 2019. https://doi.org/10.3991/ijet.v14i11.10213

[8] A. Pfeiffer, and D. Uckelmann, "Pilotierung eines didaktischen Modellkonzepts für laborbasiertes Lernen - (Digi-)LabTC für DigiLab4U", in Labore in der Hochschullehre: Didaktik, Digitalisierung, Organisation, Terkowsky, Cl. et al. (Eds.), WBV Media, pp. 111–126, 2020.

[9] D. Uckelmann, and A. Pfeiffer, "The Writing Factory: Structured Collaborative Academic Writing in Engineering", in Proc. 2021 IEEE Global Engineering Education Conference (EDUCON), pp. 99–105, 2021. https://doi.org/10.1109/EDUCON46332.2021.9453907

[10] W. H. Guilford, "Teaching Peer-Review and the Process of Scientific Writing", *Adv. Physiol. Educ.*, vol. 25, no. 3, pp. 167–175, 2001. https://doi.org/10.1152/advances.2001.25.3.167

[11] H. Sun, "The Learning Method of Peer Review in College English Writing Course", *Int. J. Emerg. Technol. Learn.*, vol. 15, no. 05, pp. 156–170, Mar. 2020. https://doi.org/10.3991/ijet.v15i05.13775

[12] T. Warden, D. Werthmann, D. Uckelmann, and M. Lawo, "TZI Technical Report 65: Proceedings of the Virtual Logistics LabPoster Session at ImViRell'12Bremen LogDynamics Lab", [online document], 2012. Available: Bremen University Online, https://www.uni-bremen.de/fileadmin/user_upload/fachbereiche/fb3/tzi/publications/Tecnical-report/65_Technical_Report_65.pdf [Accessed: July 1, 2022].

[13] J. Wintzer, "Qualitative Methoden in der Sozialforschung", Springer Berlin Heidelberg, 2016. https://doi.org/10.1007/978-3-662-47496-9

[14] H. He, "A Survey of EFL College Learners' Perceptions of an On-Line Writing Program", *Int. J. Emerg. Technol. Learn.*, vol. 11, no. 4, pp. 11–15, Apr. 2016. https://doi.org/10.3991/ijet.v11i04.5459

8 Authors

Dieter Uckelmann studied Mechanical Engineering at TU Braunschweig and received his doctorate at the University of Bremen in the Faculty of Production Engineering. Between 2005 and 2012, he has established and managed the LogDynamics Lab at the University of Bremen. Since 2012, he is a professor for Information Logistics at University of Applied Sciences Stuttgart, Schellingstraße 24, 70174 Stuttgart. The focus of his research work is in the field of the Internet of Things, Industry 4.0, and Smart Buildings, the value of information, as well as on lab-based research and education. From 2018 to 2022, he coordinated the project DigiLab4U. Furthermore, he is co-editor of the "International Journal of RF-Technologies: Research and Applications". Prior to his academic career, he has been working in different management positions for several IT companies.

Sven Judel studied Computer Science at RWTH Aachen University from 2013 till 2018 and is currently working there as a PhD candidate. His research focuses on Learning Analytics, especially performant and scalable Learning Analytics infrastructures, Learning Analytics Dashboards and Data Literacy in Learning Analytics. He supervised multiple proseminars and seminars where the descripted process of scientific work was applied successfully.

Sergej Görzen studied the Bachelor program for Computer Science at Cologne University of Applied Sciences from 2012 to 2017. In parallel, he worked as a software engineer and reached finally the position as a Lead Developer. For his master degree, he switched 2017 to RWTH Aachen University and graduated 2021. Now, he is working there as a PhD candidate. His research mainly focuses on development methods of educational VR applications, but he also supervise seminars with the described process of scientific work. Further, he is responsible for the enhancement, support and maintenance of the described application SWOFI.

Christoph Greven studied Computer Science at RWTH Aachen University and graduated in 2013. Afterwards, he joined the Learning Technologies Research Group at RWTH Aachen University where he led some research projects with main focus on learning and knowledge management. Furthermore, his engagement in teaching covering many Bachelor and Master proseminars, seminars, and theses connects him to his doctoral project on how to improve the guidance of academic learning processes. One outcome of this work was SWOFI as a generic software process guide and a template working process for proseminars, which are also subject of investigation in this paper. Since 2021, Christoph Greven works for a worldwide logistics company in industry and is responsible for the data integration and streaming related to their strategic european land transport systems.

Ulrik Schroeder studied Computer Science at TU Darmstadt, where he received his doctorate in software engineering. After postdoctoral research at the Center for Lifelong Learning and Design (L^3D) at the University of Colorado at Boulder and a substitute professorship at TU Darmstadt in 1999, he was appointed to professor for Computer Science and its didactics at the Pädagogische Hochschule Ludwigsburg in 2000. Since 2002, he has been head of the teaching and research group for learning technologies and didactics of computer science at RWTH Aachen University. His research focuses

on learning technologies, learning analytics, VR/AR in education, web technologies, and computer science didactics, especially methods and tools for supporting learning processes as well as methods and tools for qualitative feedback on practice and learning tasks. He is a member of numerous academic committees, a reviewer and program committee member for various conferences and journals, and the director of the InfoSphere student lab at RWTH Aachen University. Ulrik has authored 300+ papers and has been reviewer for 40+ doctoral dissertations.

Article submitted 2022-09-01. Resubmitted 2022-10-14. Final acceptance 2022-10-15. Final version published as submitted by the authors.