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Textile finishing as *inverted classroom* with OPALWiki

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Abstract

An inverted classroom method (ICM) in combination with a Wikipedia (wikis) was implemented in the context of second courses in the field of textile finishing. The Wikipedia is part of the OPAL learning platform. The presented teaching-learning concept includes the creation of the wiki based on self-learning assignments as asynchronous learning units, which are presented in a synchronous phase in the course by means of an implementation method chosen by the students themselves. This part corresponds to the ICM. Furthermore, the course content was again entered into OPAL asynchronously as a wiki. As quality assurance methods, both a *peer review process* for the entries and an interim evaluation were carried out.

Im Rahmen zweiter Lehrveranstaltungen im Bereich Textilveredlung wurde eine *inverted classroom*-Methode (ICM) in Kombination mit einem Wikipedia (Wikis) umgesetzt. Das Wikipedia ist Teil der Lernplattform OPAL. Das vorgestellte Lehr-Lern-Konzept beinhaltet die Erstellung des Wikis auf Basis von Selbstlernaufträgen als asynchrone Lerneinheiten, die in einer Synchronphase in der Lehrveranstaltung mittels einer durch die Studierenden selbst gewählten Umsetzungsmethode vorgestellt werden. Dieser Teil entspricht dem ICM. Des Weiteren wurden die Lehrinhalte wiederum asynchron als Wiki ins OPAL eingepflegt. Als Qualitätssicherungsmethoden wurden sowohl ein *peer review*-Prozess für die Einträge als auch eine Zwischenevaluation durchgeführt.

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1. Introduction

In the course of my work as a lecturer in the field of fiber production and the interface design of these, I experienced what it means to familiarize oneself with new topics for a lecture series that was not in one's own previous scientific focus. For example, one of these new topics included textile finishing.
Textile finishing (Fig. 1) has been and continues to be an essential part of the education of textile machinery engineers, and in a sense occupies a frontier area, since it involves both an understanding of the machinery, process concepts, processes, and technologies involved in textile finishing, but also necessarily the chemical background, which, it is to be presumed, would not otherwise be found in the curriculum and module plans of conventional mechanical engineers.

Fig. 1: Textile finishing - dyeing and finishing of textiles © ITM

Accompanying this with the currently very diverse *online learning opportunities that* students were accustomed to, the challenges now arose:

- To open up or expand a field of expertise for myself,
- 'Teaching chemistry' to mechanical engineers,
- To develop an interesting teaching-learning concept for (originally one) course that meets the students' requirements - preferably a hybrid concept.

In the end, it became an *inverted classroom concept* complemented by an OPAL Wikipedia (wiki).

2. Target group of students

The students were mechanical engineers from the 8th semester of the diploma course 'Processing and Textile Mechanical Engineering' with the course 'Machines and Technologies of Textile Finishing' (MTdTV, 3 semester hours per week) as well as students in the 2nd semester of the subject 'Textile Finishing 1' (TV 1, 3 SWS) in the master's course Textile and Ready-made Clothing Technology (MaTK). The prerequisite for attending this course was a basic knowledge of fiber materials, technical textiles and the usual fiber processing procedures, such as surface (weaving, knitting, ...) and yarn formation. Both textile finishing courses were held as a series of lectures in the summer semester (SS), but differed in the distribution of SWS with regard to the lecture (VL) and practical units.

3. Content and implementation of the teaching-learning concept

The original planning concept included the inclusion of one course. However, due to the low number of participants in one course (diploma), I decided to include the second course on textile finishing (master), so that a total of 10 students were involved. Furthermore, there was already a first version of the implementation of this teaching-learning concept in SS 2021, in one of the two courses (MTdTV), whereby challenges still to be solved arose, which were addressed in the current SS 2022.
Basically, the concept was based on an *inverted classroom* (inverted *classroom method* [1-3], ICM), where students present a topic at the beginning of each VL and enter into discussion. The presented topic was then the content of the syllabus or module description, but was not presented by the instructor. In order to make the developed topics sustainable, they were subsequently stored in the form of a wiki

in the OPAL learning platform. It became apparent in the summer semester 2021 that there were various difficulties in the implementation, such as a loss of motivation of the students to work out and present the topics even towards the end of the semester, so that I always had one or two emergency slides available despite the presentation of the topic by the students. Furthermore, the quality of the various wiki entries varied significantly: either an entry was not created, too many students had worked on a topic, or only one started a topic but it was not sufficiently illuminated.

Sequence of the teaching-learning concept:

1) Students receive self-study assignment (text, photo, video (VL), ...)
2) Self-learning phase (individual, group, research, ...)
3) Presence phase
   - Collect questions after lecture first
   - Response by the auditorium (*think-pair-share*, active plenary)
   - Deepening/Application
   - Questions (apply what you have learned in a different context = practice task)
   - Group work
   - Lectures
   - Pro & contra groups

Based on the teaching-learning concept and the experiences from SS 2021, supplementary changes to the concept were made for SS 2022:

- In the first VL the concept for the complete LV was explained by the lecturer.
- Specific topics were assigned for each VL, which were elaborated by a student as a self-learning assignment (asynchronous learning unit) and subsequently presented (synchronous learning unit). For each of these topics there was a *reviewer* from the ranks of the students, who took over the *proof-reeding of* the wiki draft (*peer review* process) / editorial responsibility.
- The way of presenting the topics was left to the students, so there were PowerPoint presentations as well as presentations as a normal lecture, using pdfs or in the form of classical blackboard pictures and derived equations (Fig. 3).
- The wiki entries created were also reviewed by the instructor afterwards.

In SS 2021, it became clear that this concept can also be implemented completely digitally.
In SS 2022, however, the course TV1 took place completely hybrid, i.e. VL is transmitted via Zoom. The students could therefore also present their topics or ask questions as online *listeners.* Questions about the topic were asked directly by the auditorium to the lecturing student. Example pages for the wiki can be seen in Fig. 2 and Fig. 4.
Another advantage of the wiki (Fig. 2) was that both the students of the MTdTV and TV1 courses could access it. In this way, all students had access to the information and could benefit from the content of the other, thematically similar LV and self-study phases.

Fig. 2: Home page of the Textile Finishing Wiki, schematic diagram

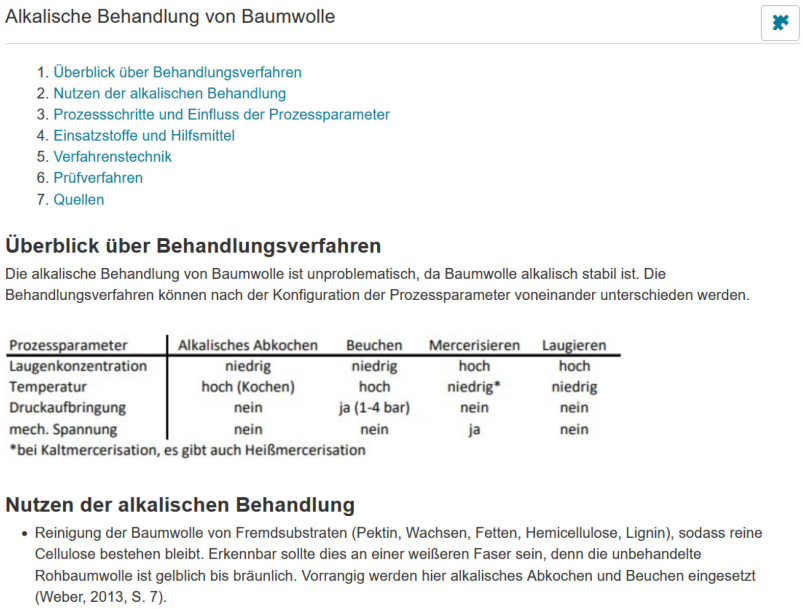
I think that the wiki is particularly useful for the course TV1, because the exam for this textile finishing lecture takes place together with 'Textile Finishing 2' (TV2) in the winter semester (WS), and the wiki makes it easier for the students to access and repeat the contents of the SS during the self-study phases.

4. Learning objectives

According to the module description, the classically intended learning objectives of this course primarily included the first three taxonomy levels according to BLOOM and ANDERSON and KRATHWOHL [4-5], i.e. knowledge, application and understanding, whereby the processes and procedures with a textile-chemical focus, use and functional requirements as well as quality assurance (application of measuring

technologies and tests as well as fastness analyses) were mainly in the foreground in the textile finishing context. In addition to the 'classical' learning levels mentioned above, which extended to analyzing, linking, judging and creating, further complementary competencies emerged in the course and through the implementation of the teaching-learning concept from the work in the ICM and in the creation of the OPAL Wiki (Fig. 2 and Fig. 3).

These competencies included, for example, the acquisition of knowledge and independent research with the help of technical literature (journals, textbooks, ...), the Internet or alternative sources (videos, YouTube, ...). Furthermore, the acquired knowledge had to be formulated concisely and reduced to the essential statements and described..



Alkalische Behandlung von Baumwolle

1. Überblick über Behandlungsverfahren
2. Nutzen der alkalischen Behandlung
3. Prozessschritte und Einfluss der Prozessparameter
4. Einsatzstoffe und Hilfsmittel
5. Verfahrenstechnik
6. Prüfverfahren
7. Quellen

Überblick über Behandlungsverfahren

Die alkalische Behandlung von Baumwolle ist unproblematisch, da Baumwolle alkalisch stabil ist. Die Behandlungsverfahren können nach der Konfiguration der Prozessparameter voneinander unterschieden werden.

Prozessparameter	Alkalisches Abkochen	Beuchen	Mercerisieren	Laugieren
Laugenkonzentration	niedrig	niedrig	hoch	hoch
Temperatur	hoch (Kochen)	hoch	niedrig*	niedrig
Druckaufbringung	nein	ja (1-4 bar)	nein	nein
mech. Spannung	nein	nein	ja	nein

*bei Kaltmercerisation, es gibt auch Heißmercerisation

Nutzen der alkalischen Behandlung

- Reinigung der Baumwolle von Fremdsubstraten (Pektin, Wachsen, Fetten, Hemicellulose, Lignin), sodass reine Cellulose bestehen bleibt. Erkennbar sollte dies an einer weißeren Faser sein, denn die unbehandelte Rohbaumwolle ist gelblich bis bräunlich. Vorrangig werden hier alkalisches Abkochen und Beuchen eingesetzt (Weber, 2013, S. 7).

Fig.3: Example page 'Alkaline treatment of cotton' from the textile finishing wiki

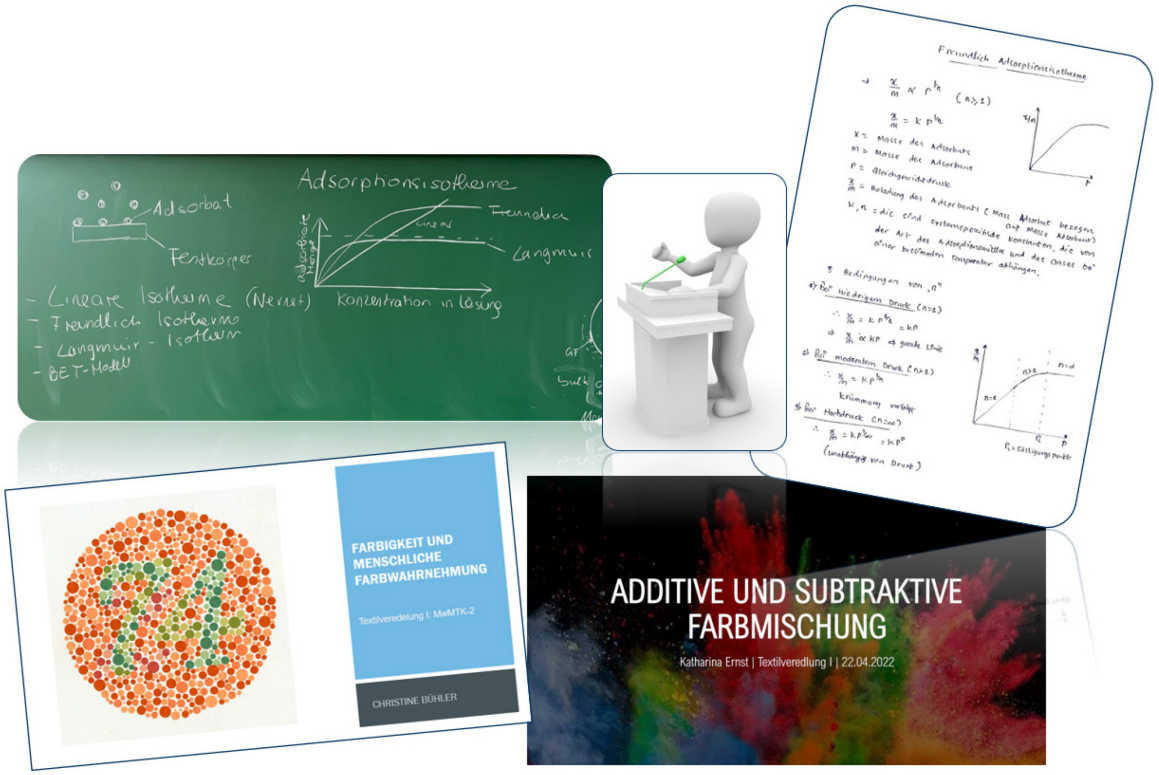


Fig. 4: Presentation variants of wiki topics for face-to-face and hybrid teaching of students.

In the *peer review* process, the students also learned to analyze and evaluate - but in order to do this, the 'controlling' students had to delve into the respective topic as well as compare their own knowledge with the acquired knowledge and also evaluate and assess it. Another advantage of the OPAL Wiki was that the students had to deal with the creation of such an entry (Fig. 4), among other things (*soft ware, soft skills*). The ICM also enabled the students to deal with the development of their own concepts for knowledge transfer, e.g. to work out their own representations of functional principles and facts (Fig. 4)

5. Quality assurance, feedback and evaluation

The quality assurance of the teaching-learning concept was carried out on the one hand by the lecturer in the context of the VL, as a contact person in the ICM. On the other hand, the wiki was secured through the *peer review* process by the students and also by the lecturer. The scheduling of when who was responsible for which ICM/Wiki article and for which *peer review* also resulted in organizational quality assurance.
The method of the 'self-formulated exam question' was also used in one course (MTdTV). At the end of one of the lectures, the students were asked to formulate their own exam questions (2 min, moderation cards) on the lecture that had taken place, which were used to identify levels of understanding (Fig. 5). These, together with the learning success questions, formed a content-related basis for potential exam questions.

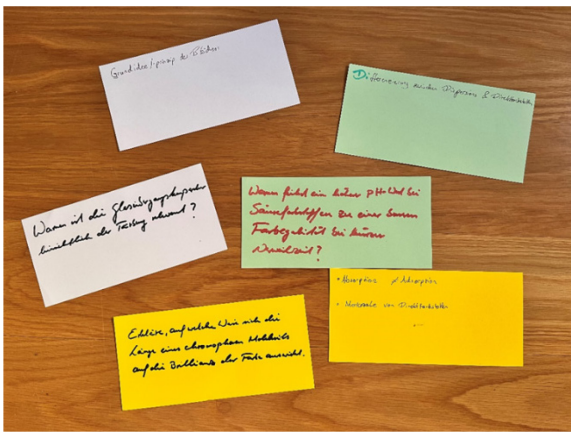


Fig. 5: "Student" exam questions from the course

Furthermore, an interim evaluation of the course took place during the SS, from which feedback on course TV1 and the entire teaching-learning concept ICM and OPAL-Wiki could be obtained:

"Through the inverted classroom, one's own topics and also those of fellow students were perceived and internalized more intensively. It was always an interesting change from the classic lessons."

"- Content of the topic you present you master super, better than in a normal lecture.

- Topics of others often worse, depending on how well the topic was worked up and how well it was presented by the person in question"

"When I had to create a presentation for the group myself, it really helped me professionally in this subject."

The disadvantage perceived by the students of knowing only one's own subject, and those of others worse, was an effect that may well occur with other teaching concepts and methods, so that these should not be regarded as a fundamental disadvantage of ICM.

6. Summary

It had been shown that working out and presenting the individual textile finishing topics was very well received by the students and that the ICM with Wiki was a useful supplement to the lecture. It was also easy for the lecturer to identify comprehension problems that could be addressed during the lecture or in general during the course, and the ICM represented a kind of feedback system.

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