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Design of a teacher-training workshop to support research-based learning processes with digital media

In this paper we discuss the design of a workshop to support teachers in the conception of research-based learning processes with digital media in their teaching at the University of Oldenburg. The workshop is taking place as a blended-learning training activity within the BMBF-financed project "Forschungsbasiertes Lernen im Fokus plus (FLiF +)[1]".

1. eDidactics in the FLiF+ Project

According to the forschen@studium (2017) *Grundlagenpapier*, the University of Oldenburg has committed itself to develop research-based learning and teaching as a main characteristic in its teaching profile. The level of research-based learning that a specific course or program aims for is determined by the type of student activity (see table).

	Research Question, prior research results	Applying research methods	Presentation of results
(C) Self-conducted research	Review literature and develop own research question	Carry out research, evaluation and interpretation	Present own research and results
(B) Analyse and /or practice	Analyse and compare research results and transfer to specific subject	Analyse and discuss uses of research methods in specific research	Analyse and practice academic presentation formats
(A) Get to know basics of research	Knowing about research results	Knowing how to apply research methods	Knowing about academic presentation formats

Table 1. Research-based Learning Levels at the University of Oldenburg. Source: forschen@studium (2017).

Students can engage with the main parts of the research processes (first row) - (1) research results and research questions, (2) research methods and (3) the presentation of results - on three levels of activity (A-C). Research-based learning on level A means to acquire knowledge on those three steps of research,

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[1] Official website for the project: https://www.uni-oldenburg.de/forschen-at-studium/

learning activities on level B comprise the analysis and transfer of existing knowledge, the analysis and practising of research methods and the practising of presentation formats. Research-based learning on level C is required to be "self-conducted research". Students first engage with existing research results and develop their own research questions. Next, they develop a research design, apply appropriate research methods, evaluate and interpret findings and, finally, choose suitable formats for presentation of research results. As the students become actively engaged in self-conducted research they experience it as a construction process and recognize that the process as and the results are formed by their own decisions as researchers. By their active involvement, they have a chance to learn that the production of knowledge is a process that can be opened up to critical reflection. It is the goal at the University of Oldenburg that all undergraduate students go through an experience of a full research cycle on level C during their studies. This learning format requires the active participation of students in self-directed processes of learning and cooperation. In order to provide the grounds for successful processes of self-directed learning the guidance and scaffolding of teachers is required.

The use of digital media is one of the aspects teachers need to consider when designing the learning processes on the three levels previously described. Using digital media in research-based teaching and learning offers new possibilities for enhancing the self-directed learning both in individual and group facets. It also enables the development of key competences, such as information competence, ability for self-organization or the competence for solving problems, and it empowers social learning (Dümberger, 2014). Some possibilities connected to research-based learning are, for example: 1) to improve the information mediation (text, image, audio or multimedia), and by doing so, making the process of information reception easier; 2) to design the tasks and make more interactive the practice of learning with social media, even proposing new forms of communication and cooperation in the teaching-learning processes (online communities, social networks); 3) to propose new forms of reflection of the learning process using digital videos or e-portfolios (Hofhues, Reinmann, & Schiefner-Rohs, 2014).

In the context of the unit of *Hochschuldidaktik (academic teaching)*, digital media are seen as tools to be used as a support to enhance teaching and learning (eDidactics). Following this aim, the *e-Didaktik[2]* area of the *Hochschuldidaktik* of the University of Oldenburg emerged as an offer for the university teachers when incorporating digital media in the higher education classroom. It includes personal and group support for teachers for the development and implementation of didactic concepts. Face-to-face and blended training workshops are offered as

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[2]   https://www.uni-oldenburg.de/lehre/hochschuldidaktik/e-didaktik-lehren-und-lernen-mit-digitalen-medien/

well as periodical meetings for a peer exchange of didactic experiences. The goal is also to create a follow-up virtual community, so that issues can be described and further discussed after meetings. In addition, the *e-Didaktik* at the University of Oldenburg provides information about the didactic use of different digital tools through a public blog[3]. All teachers can contribute to the blog by including their evaluations and describing their experiences with such tools. The basis of this offer is the idea to actively build a community of practice (Wenger, 1998), where the teachers of the University of Oldenburg can share their concern or passion for teaching through a mainstream use of technologies and learn how to do it better as they interact regularly.

2. Digital media in research-based learning processes

With the purpose of providing an overview of different categories of tools in connection to the processes of research-based learning, we developed a map with some examples as orientation for teachers to decide on the type of tools (see figure 1).

The map of the research-based learning process presented here is supposed to be understood as an example. While the phases are generally applicable for research processes in most fields, the activities of research and learning may differ considerably according to the research field. For example, the activities of quantitative and qualitative social research differ. Research in the sciences will often focus on activities that go along with experiments, such as the documentation of an experiment. Action research requires another kind of activities as interventions are planned, implemented and evaluated; for example, in educational studies, that could mean the design, development, implementation and evaluation of a lesson plan. Research in engineering also differs from the other fields with regard to its goals and methods, which comprise for example the writing and testing of software.

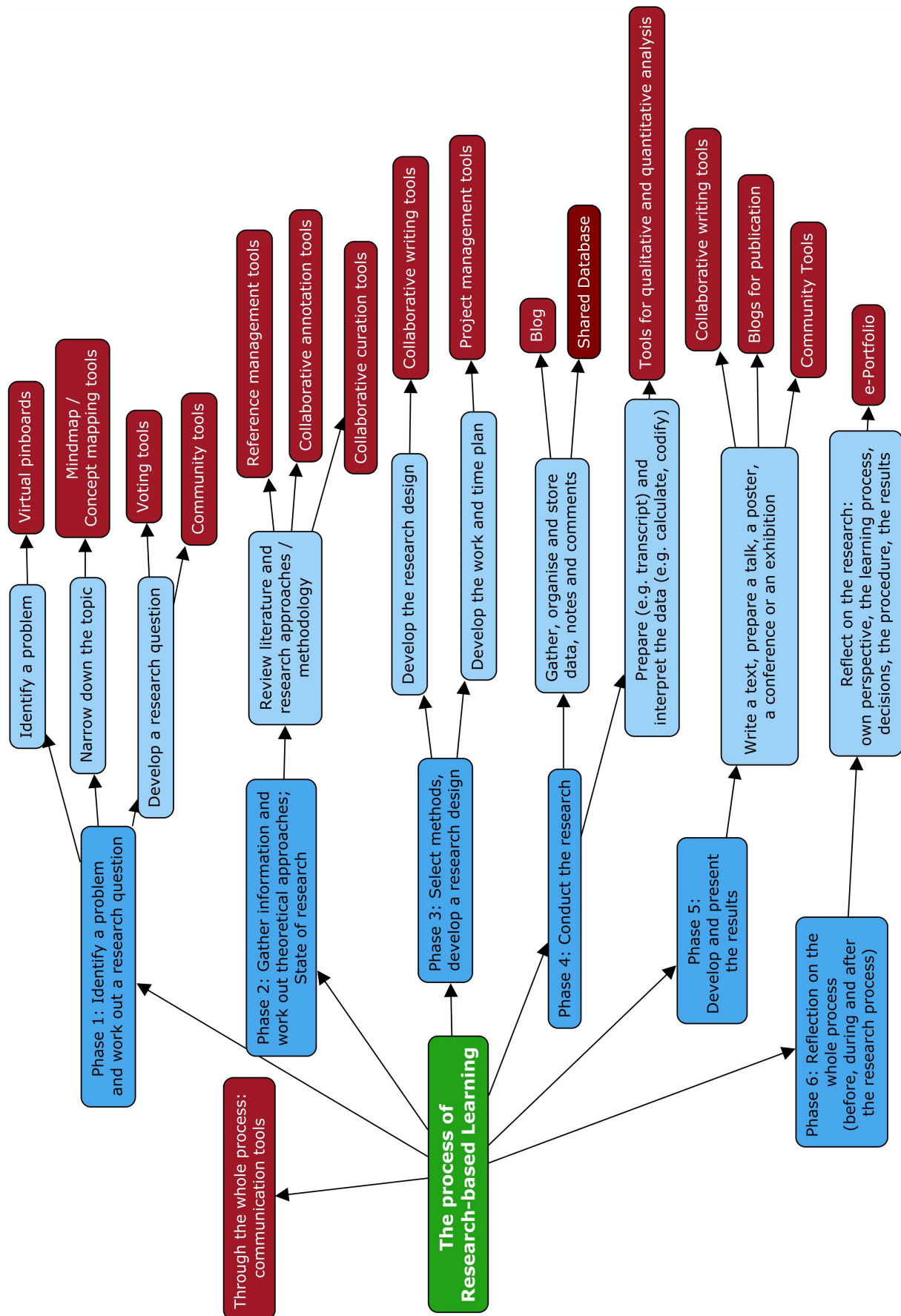[3]　　e-Didaktik Blog: https://wp.uni-oldenburg.de/edidactics/uber-das-blog/

Figure 1. Overview of the research-based learning phases with different categories of tools.

Therefore, that map described here was also used in the workshop as an example. The teachers were asked to identify the activities typical for their own field and the associated learning activities of their students. In the next step they started to collect ideas of which digital tools could be used in the specified learning activities. For example, in the first phase, related to the identification of a problem and the development of a research question, the ideas regarding a specific topic could be collected and maintained through a virtual pinboard. To develop the main concepts and relationships among them based on a research question, we can use concept maps, which support the inclusion of media-rich resources, e.g. figures, videos, links or other concept maps.

Some of the tools can be used in different types of research and in several phases of a research-based learning process. For instance, tools for collaborative writing can be useful for a number of different tasks. In many cases it is recommendable to use tools for project management throughout a research process, individually or as a group. Another tool that could accompany every research process, particularly in research-based learning, is a reflective e-portfolio. Ideas, doubts, problems and decisions can be stored and reflected upon.

Many other tools might be useful for research activities that are specific to certain fields of research. This opens up an interesting task as part of teacher training: the teacher's experience and knowledge of research processes and of the teaching in their own field are the basis on which to develop ideas and concepts for the use of technologies in teaching together with the experts on digital media. On that basis, the TPACK (technological pedagogical content knowledge) framework is depicted by Mishra and Koehler (2006) as the teachers' knowledge required to integrate digital media into the instruction of specific topics within a discipline area (Koh, 2013, p.887). The idea of the concept is that teachers will develop their own "TPACK": a specific combination of technological, pedagogical and content knowledge. For instance, teachers in mathematics should not only master their subject knowledge, but also need the didactic skills to teach the subject plus the ability to do that using suitable digital media. Then, a task of the teacher training in this context is promoting the teachers' design of meaningful learning activities with digital media in each subject field.

3. The reflective practice as a teacher

Reflective practice refers to professionals, in our case the teachers, making meaning from a given event (e.g., a learning activity in a class) so that they can better understand their professional practice and improve it. That can happen in the form of cycles of reflection, as Gibbs proposes (1988), considering from the description of what happened until the action plan of what the professional would do in the future, going through the expression of the own feelings within

that situation, the evaluation of the experience and the analysis of the situation and the possible options.

Teachers as reflective practitioners is a topic extensively covered by literature based on the ideas of Schön (1983). He distinguishes between two forms of reflection: reflection-in-action and reflection-on-action. The first one refers to the process in which the professional is looking at the particular experience in progress. The professional knowledge is actually being used (knowing-in-action) and the practitioner is reflecting on it at the same time. This process also involves connecting with the own feelings and paying attention to the own theories in use. In this case, reflection-in-action would help teachers build new understandings to inform their own actions in the situation that is unfolding.

The second one, reflection-on-action, is related to the process of looking at and reflecting on the experience after being carried out, when it is finished. This kind of reflection enables teachers to take their time to explore the reasons behind their actions and the events under way in the group. That allows teachers simultaneously to critically examine their knowing-in-action by developing sets of questions and ideas about their own practice and activities, and reformulate and test that collection of ideas in further action.

In the context of eDidactics, we consider teachers' reflections as practitioners a key process in the design, application and evaluation of learning activities with digital media in research-based learning in different disciplines. Therefore, we encourage teachers, not only to enhance students' reflection in research-based learning processes, but also their own reflection on their practice. That reflective process can also take place in the digital context, through multimedia creation in the form of videos or slideshows or reflective writing in the form of a learning diary or journal or as answers to reflection prompts about the learning experience, e.g. in Blogs, as we propose later in our Workshop.

4. The Workshop "Research-based learning with digital media"

The workshop offered by the *Hochschuldidaktik* was directed at supporting teachers in designing research-based learning processes with digital media in their courses. It was organized as a blended learning seminar.

The participants were seven university teachers from different fields (Biology, Pedagogy, Special Education, Medicine, Theology), although only five took part in the whole process. Some of them had already experience with digital media in their teaching, but some did not.

4.1. The concept and the activities

The seminar was structured in three temporal moments, according to the development of the academic semester at the university:

– Before the semester, the teachers attended a one-day training session, in which they were introduced to the use of digital tools in the framework of research-based learning and were asked to start designing an activity plan for their own teaching. Our focus was on technologies that support the collaborative processes in research-based learning and teaching among teachers and students, and among students, such as e-portfolios, Wikis, collaborative writing tools (e.g. Etherpad), shared mind maps and concept maps or annotation tools, as well as online project management tools. Some of the tasks addressed to the teachers in this phase were accordingly:

1. Read in pairs an article about research-based learning and present its contents using a mindmap tool (Mindomo) or an annotating tool (Nowcomment and NB). Then reflect on the relation with your teaching, and how you can imagine the use of these tools in your class.

2. Use an online pinboard to brainstorm and to describe the course activities in which the students should work together. Join the activities with the phases of the research process and possible digital tools.

3. Plan an activity in your teaching where one or more digital tool is used. Then review each others plans and present them to the group.

   Teachers were given a template for this description with different elements, as follows in the picture from the WordPress template example:

Figure 2. Template for the workshop task of designing a learning activity.

– During the semester, face-to-face and online individual support was provided as needed. In addition, a 2-hours exchange meeting was organized during this phase. For this meeting the teachers were asked to describe their planning of activities (continuation of task#3), how the planned activities worked out in their courses and to reflect on the process. These steps were to be taken in their e-portfolios using an institutional installation of WordPress, while the facilitators provided feedback to them. An assessment rubrics, which considered different criteria (e.g., the specification of the learning objectives of the activity or its phases) and levels of achievement, was designed.

– Three WordPress post entries for this online task were given, following the Gibbs' reflective cycle (1988) and the concept of the reflective practitioner of Schön (1983) and his ideas of reflection-in-action and on-action (see Table 1).

Type of reflection	Instructions	Reflection prompts
Reflection-in-action	Feel free to talk about your personal reflections during the first time/phase for the activity that you carried out in your seminar (and similar new posts for the following phases of the activity-in-action).	What happened? What were you thinking and feeling? What was good and bad about the experience in process?
Reflection-on-action	Feel free to talk about your personal reflections after the activity that you carried out in your seminar (if you developed more than one activity you can create more posts for the reflection-on-action).	What was good and bad about the whole experience? What sense can you make of the situation? What else could you have done? If it arose again what would you do?
Reflection-on-action (end of the course)	Reflect on the overall experience with digital media in your teaching and write a short comment. Remember to focus on the didactical aspects and not on the technical features of the tools.	What did you do in your teaching? Which were the didactical potentials of the tool in your case? What was good and bad about the whole experience? If you were doing something similar again, what would you do differently? Which recommendations would you give to a teacher that would like to use the same tool?

Table 1. Reflection tasks on the design of the learning activity.

– After the semester a wrap-up half-day session was carried out in which the participants shared their final didactic experience and started considering which their next steps would be in the upcoming semester. The meeting also provided the opportunity to discuss and exchange ideas with the IT developers of the University's learning management system Stud.IP.

4.2. Results

Challenges and potentials of the seminar were identified by the facilitators during its development, but also afterwards through the participants' evaluation.

As challenges, two of the main highlights were that the learning effort involved in the use of digital media for research-based learning processes was greater than expected, and that enough time for experimentation and reflection was required. Another aspect was that the German and EU data privacy law restricts the use of technological tools in non-European servers. That situation sets limits for the use of digital media by students in the courses. It is preferable to offer

and suggest tools that are hosted on the university servers of that institution where the digital media will be used by students and teachers.

The key for the seminar to become an enabling experience was the didactic and technical support that was needed from the teachers and provided by the facilitators. Also, learning by doing with digital media, which was one of the main strategies of the seminar, was valued as meaningful and positive by the teachers. From the exchange session with the Stud.IP IT-developers of the University was also inferred that they may consider teachers' demands for the development of new Stud.IP plugins. In that way the teachers could conform to the regulations of the German data privacy laws.

Another issue that the teachers brought up and that we consider a potential to develop further in the near future is the establishment of regular exchange meetings between teachers. They would consider it helpful to share experiences and ideas of using digital media in their teaching, especially in connection with the research-based learning processes. Concerning this last aspect, we highlight the strengthening of the tie between digital media tools and research-based learning both as a challenge and potential. The enhancement for each of the phases of the research-based learning processes supported by digital media should be made clearer.

As facilitators of the seminar, we highlight that the blended learning workshop formats for teacher training are still to be further developed. Our own reflections on each session of the seminar were helpful to improve and develop a second version of the format, as well as to reflect with the participants on the outcomes and the process.

5. Next steps and conclusions

The setup of this workshop provided the teachers with the opportunity to use and explore collaborative technologies for research-based learning and teaching processes and reflect on that practice in successive steps using e-portfolios, while they were planning the use of the same digital tools and similar methodology in their own courses

By reflecting the planning, process and results of this workshop, an example of how to enhance research-based learning and teaching processes by using digital media has been provided. In addition, exemplary categories and specific tools are proposed in Table 2. However, no universal tool solutions are identified and the example should be considered carefully in the light of the already available institutional tools.

Category	Tool	Teachers comments
Collaborative writing	Wordpress (Free, Open Source, Self-/Web hosted) (http://bit.ly/2Cg8TRR)	„I used the wordpress blog as part of an introductory lab course in physics. It is a great tool for promoting a transparent evaluation of labwork from students groups, it helps them understand better their own results in the light of what others did, and also to question suitable ways of reporting results and dealing with data in a collaborative way." „Each of the student research groups in the seminar had their own ‚page' with subpages to organize and carry out their research. That way students could gain insight into the processes of other groups. On the main page of the blog I provided general information regarding the course."
Pinboard	Padlet (Free, Web hosted) (http://bit.ly/2FsH5sd)	„Suitable for collecting ideas in group work. (…) A good simple tool for collaborative brainstorming."
Collaborative annotation	Nowcomment (Free, Web hosted) (http://bit.ly/2EOrEJB)	„Students can online read and comment texts collaboratively. This can be a good start to develop research questions together."
Mindmapping/ concept mapping	Cmaptools (Free, Self-/Web hosted) (http://bit.ly/2GCGuDD)	„Very useful to sketch and present a research design.(…) The students in my course rated the tool as helpful and said they could envision its usage in other courses."

Table 2. Example of proposed tools for RBL.

Some suggestions for the successful design of teacher training with and for digital media use in research-based learning could also be extracted. It is necessary to provide enough time to experiment with tools that teachers might not be familiar with. In addition, teachers should have the possibility to receive continuous support. Careful planning and moderation has to ensure that issues of the technology, such as technical problems or legal questions, do not distract from the topic of designing research based learning activities as well as from the didactic chances and shortcomings the digital tools offer.

As for the follow-up of this workshop, a second cycle is being developed, considering all the appreciations from the participants. Regular exchange meetings with the participants will take place after the courses end.

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