

## Self-learning module "Mentoring digital Undergraduate Research" How to use the Study Guide

The train the trainer module "Mentoring digital Undergraduate Research" was developed as part of the Erasmus+ project "A European network for undergraduate research" (digiUR). It was originally designed as a four-week online-module for university teachers who want to receive information how to support students in digital undergraduate research. After a first implementation the material was revised and modified to become a self-learning material.

### Guidelines for institutions of higher education didactics

The module "Mentoring digital Undergraduate Research" gives a short introduction to undergraduate research before concentrating on mentoring issues with a focus on digital mentoring.

The module was originally developed and piloted in a four-week online course and has a workload of approximately 40 hours. The core of the module is the Study Guide, which projects the learning path. It can be conducted in a time frame that suits the learners best. Suggestions of the pilot's participants ranged from four weeks to one semester, depending on the available amount of time of the participating university teachers. The module should be conducted with a group of at least four to five university teachers. Larger groups can be divided into subgroups of three to four participants each.

It would be helpful to have an "instructor" leading through the course and especially coordinating the group meetings (online or personally) and group discussions. The groups or subgroups should elect a group leader during the first meeting to coordinate the group work during the course. One or two group meetings for each chapter are recommended. The participants can simply follow the instructions in the StudyGuide to work through the module. The tasks referring to the e-portfolio can be done with any e-portfolio tool on hand, by using a blog or even on a paper-pencil basis.



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# Self-learning module "Mentoring digital Undergraduate Research"

## How to use the Study Guide

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### Guidelines for university teachers

The module "Mentoring digital Undergraduate Research" gives a short introduction to undergraduate research before concentrating on mentoring issues with a focus on digital mentoring.

The module was originally developed and piloted in a four-week online course. The core of the module is the Study Guide, which projects the learning path and has a workload of approximately 40 hours. It can be conducted in a pace and speed that suits you best. To gain more impact from the module, you might want to form a group of at least three to four participants in total, as group work and group discussions are a fundamental part of the course. You can also use the material on your own, but you might gain a bigger benefit by working in a group.

You can simply follow the instructions in the Study Guide to work your way through the module. There are many tasks referring to an e-portfolio which can be done with any e-portfolio tool on hand, by using a blog or even on a paper-pencil basis.

You will find several invitations for group discussions in the Study Guide. If you are using the module individually, you could also discuss the given topics with colleagues or other suitable people.

If you form a study group to work with the module, it might be useful to elect a group leader, who leads through the process. Furthermore, we recommend to arrange regular group-meetings – online or in person- at least once for each chapter.

Everything else you have to do now, is follow the instructions in the Study Guide.



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StudyGuide

# Mentoring digital Undergraduate Research

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## Course objectives

This material covers the following content:

- What is Undergraduate Research? Which steps constitute research-based learning?
- What role does mentoring play in Undergraduate Research? What is good mentoring?
- How can teachers use digital tools to support their students in research-based learning? Which digital tools are useful? If so, in which phase(s) of the learning process?
- What are best practice examples for student research and mentoring?

## Learning outcomes

After successful completion of the module...

- you know the concept of research-based learning and the phases it can be divided into
- you know why mentoring is particularly important and
- you know what constitutes good mentoring
- you can assess the benefits of using digital tools in certain phases of research-based learning
- you know the most important communities, conferences and publication opportunities for students in the field of research-based learning
- you know best practices in the field of successful mentoring and successful student projects

## Working with the self-study material

This material is an adaption of the StudyGuide which was developed for an online module of four weeks. The content was revised for self-study purposes, the likely amount of work is at about 40 hours. You can work through the provided material in your own pace and speed. In each chapter you will find accompanying tasks for your self-reflection, i.e., to reflect, transfer to practice and critically question the course content. If you have a study-group for this course, you can discuss these questions in your group-meetings.

You can choose your own medium for answering these self-reflection questions: you can use an ePortfolio- or Blogging Tool (as for example WordPress), or you can do it using the good old paper/pencil solution – it is up to you. Most important is that you choose the medium you can work best with.

► Get to know the StudyGuide. Complete the activities. Read the literature.

# 1. Introduction & getting started

## 1.1 Getting started

- Get acquainted to the StudyGuide. You don't have to read it completely, but try to understand how the course structure works.
- If you want to initiate a study-group, get in contact with possible team members you would like to work with and set dates in advance, if possible, one per week.
- Choose your personal ePortfolio tool which you would like to use during the course. You can of course also choose paper/pencil as your personal tool.
- Read the literature provided for each chapter and work on the tasks.
- Work at your own pace.

At the end of each chapter, you find additional literature. Most sources are open resources, available in the internet. Please have in mind that sometimes website addresses may change, we have no influence on that. At the date of publishing this material, all links were accessible. Furthermore, you will find suggestions of other literature (which is not available as open access) if you are interested to dive deeper into the specific topic.

Here comes your first self-reflection task:



Write in your ePortfolio and discuss in your group or with others:

Stephanie Wallach, assistant vice provost for undergraduate education at Carnegie Mellon University in Pennsylvania, says

"[...]it is not just for career academics: Undergraduate research is sometimes misunderstood as simply something to do because you want to go into academia, or you're planning to go for a Ph.D. That is another fallacy."

[In Moody, J. (2019): Why Undergraduate Research matters in college: <https://www.usnews.com/education/best-colleges/articles/2019-09-20/why-undergraduate-research-matters-in-college> [15/02/2023]

Why is this a fallacy? Please explain your point of view based on what you already know or have heard about Undergraduate Research: Why should students do Undergraduate Research? What do you think about it?

Do you agree with Stephanie Wallach? Should all students do Undergraduate Research? Add your contribution to your ePortfolio.

## 1.2 The benefits of Undergraduate Research

So let's think a little further about this: Why should Undergraduate Research be enhanced? What are the benefits of it?



Write in your e in your ePortfolio and discuss in your group or with others:

Think about the question above: What are the benefits of Undergraduate Research, why is it worthwhile enhancing it?

## 1.3 The history of Undergraduate Research

Not absolutely necessary but nevertheless surely interesting is to learn something about the history of Undergraduate Research. You find an overview in the following article by Kinkead (2012):

► <http://www.cur.org/assets/1/7/331Fall12KinkeadWeb.pdf> [15/02/2023]



Optional task - if you like to, write in your ePortfolio:

Read the article and try to solve Kinkead's Quiz from 2012 about the history of Undergraduate Research. Maybe you will be able to fill in the missing ten years after completing this course 😊

► Read Chapter 2. Read the provided literature. Complete the activities and writing tasks.

## 2. What is Undergraduate Research?

- ❖ What is Undergraduate Research? You will receive a definition and you will define it for yourself.
- ❖ You will learn about the phases of Undergraduate Research and how they can be useful for guiding your students in their research process.

### 2.1 Definition

The Council on Undergraduate Research ([CUR](https://www.cur.org)) defines it as follows:

“Undergraduate research, scholarship, and creative inquiry is fundamentally a pedagogical approach to teaching and learning. With an emphasis on process, CUR defines undergraduate research as: A mentored investigation or creative inquiry conducted by undergraduates that seeks to make a scholarly or artistic contribution to knowledge.”



Read and digest:

[https://www.cur.org/who/organization/mission\\_and\\_vision/](https://www.cur.org/who/organization/mission_and_vision/) [15/02/2023]



Write in your and discuss in your group or with others:

Visualize, i.e., draw a picture (it does not have to be pretty; it just should express what you think):  
What is Undergraduate Research (for you)? Hard and soft facts, as you like.

Reflection: What is Undergraduate Research? What is so special about it? What challenges could there be for the accompanying mentors? What do you like about it, what might be critical?



## 2.2 Students as independent researchers

Following the policy paper of the University of Oldenburg concerning Undergraduate Research (Leitungsteam FLiF, 2017), a university degree is always more than just acquiring improved knowledge or skills. “Academic studies” means thinking beyond the course content and knowledge, it means questioning and becoming active in the academic process.

Undergraduate Research takes place when the students, supported by the teachers, become active in research. A didactic setting is needed that supports students in their research and their individual learning processes.

The students improve their competencies while they go through a (often collaborative) research process. Part of it are all the phases usual research processes consist of:

- beginning with opening up a certain research field,
- developing a research question,
- the literature-based classification in the state of research,
- decision for a research design resp. method,
- conducting the investigation,
- evaluation and interpretation of the results,
- including a critical reflection (ibid.).

The research process thus becomes a learning environment in which research can be understood as an active construction process and critically reflected upon.

## 2.3 The phases of undergraduate research

The phases of Undergraduate Research are the usual steps of a research process, as the following graphic by [Gotzen et al \(2015\)](#), slightly modified by us, shows:

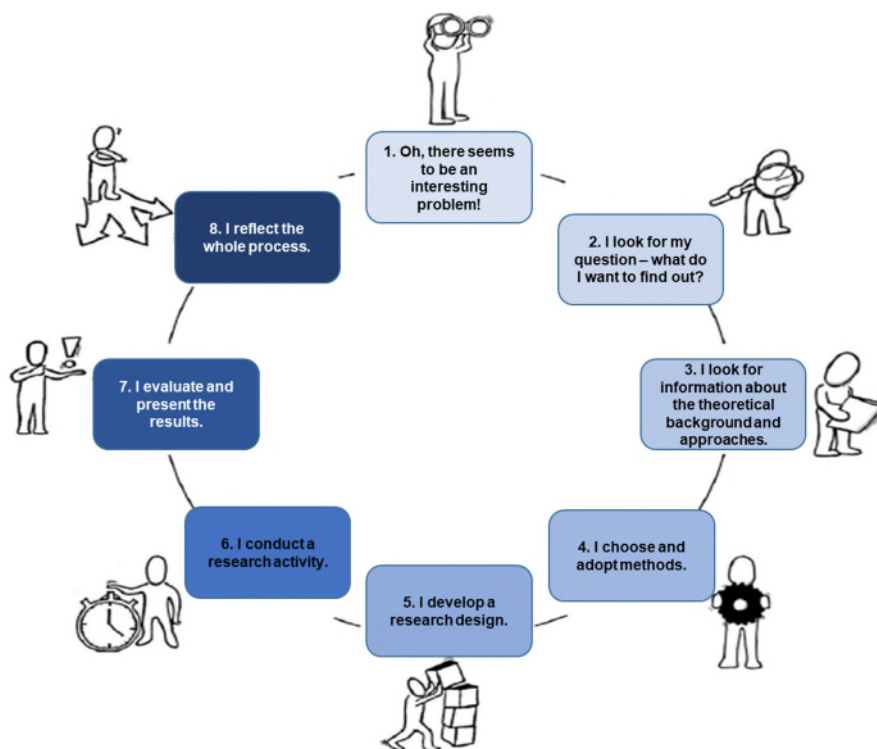


Figure 1: Own presentation based on: Huber, L: *Research-based learning: concept, justifications and challenges* (Gotzen et al., 2015), p.2, (adapted by S. Brunner)

Pedaste et al. (2015) conducted a review of 32 articles to generate an overview of the common phases and using this as a basis for proposing a comprehensive inquiry-based learning framework. They identified five general phases and seven related sub-phases; within the process, the initial 34 groups of inquiry activities were merged into bigger groups and finally into five general inquiry phases ([Pedaste et al., 2015, p.54, p. 51](#)).

Another system providing stages for the research process is the so-called “Zürcher Framework” by Tremp and Hildbrand (2012):

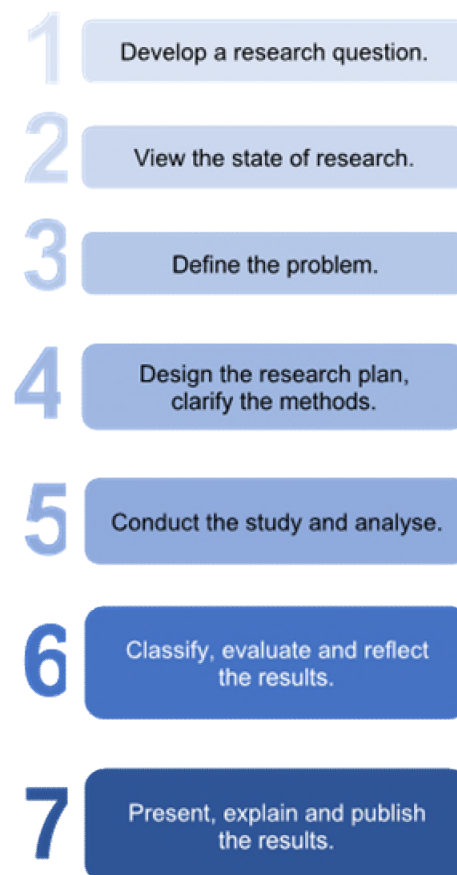


Figure 2: Stages of the research process as students' learning activities (Tremp & Hildbrand 2012; own translation and representation)

All these mentioned representations of the process phases may be slightly different, yet their aim is the same: to provide a system with which one can divide the research process in phases and thus help students managing it step by step. We will use the system of Tremp & Hildbrand (2012) in this course to think about helpful mentoring activities and assigning appropriate resp. useful tools for each phase.



Write in your ePortfolio and discuss in your group or with others:

What do you think (e.g. when you think about past courses): At which points of the research process do students especially need your guidance? How could that guidance look like? Brainstorm a bit, no need to be too structured at this point. Write your thoughts down in your ePortfolio.

► Read Chapter 3. Read the provided literature. Complete the activities and writing tasks.

## 3. Mentoring

❖ What is high-quality mentoring?

### 3.1 Mentoring Undergraduate Research

Undergraduate Research is part of an innovative and open pedagogy that has become a major focus of universities around the world. Undergraduate Research supports rapid, deep learning in a discipline, reduces dropout rates and fosters inclusion (cf. e.g., Hensel 2012).

In this time of a global pandemic, when researchers and their mentors are separated due to lockdowns and social distancing, educators must find new ways of engaging with and supporting their students. A teachers' special responsibility lies on the mentoring process, for in their research process, students benefit "first and foremost, on high-quality mentoring" (Shanahan et al. 2015). Shanahan et al. state that "Mentorship is a defining feature of UR" (ibid).

First, we take a look at high-quality mentoring. Again [Shanahan et al. \(2015\)](#): They identified ten "evidence-based practices of effective UR mentors that apply broadly across disciplines, students, institutions, and mentoring approaches" (ibid.):

- 1 Do strategic pre-planning in order to be ready to respond to students' varying needs and abilities throughout the research process.
- 2 Set clear and well-scaffolded expectations for undergraduate researchers.
- 3 Teach the technical skills, methods, and techniques of conducting research in the discipline.
- 4 Balance rigorous expectations with emotional support and appropriate personal interest in students.
- 5 Build community among groups of undergraduate researchers and mentors, including graduate students, postdoctoral fellows, and any other members of the research team.
- 6 Dedicate time as well to one-on-one, hands-on mentoring.
- 7 Increase student ownership of the research over time.
- 8 Support students' professional development through networking and explaining norms of the discipline.
- 9 Create intentional, ladder opportunities for peers and "near peers" to learn mentoring skills and to bring larger numbers of undergraduates into scholarly opportunities.
- 10 Encourage students to share their findings and provide guidance on how to do so effectively in oral and poster presentations and in writing conference presentations, research reports, and journal articles.

Figure 3: Ten salient practices of undergraduate research mentors identified from a literature review (Shanahan et al., 2015), own representation)



Write in your ePortfolio and discuss in your group or with others:

Sum up each of the ten practices in your own words. You can keep it short and simple, e.g. the first one could simply be “be prepared “. The aim of this task is to get a personal and quick overview of what is meant by each practice and what you want to consider when mentoring. Just do it the way it is suitable for you and supports you.

If you like to, find a suitable icon that makes it clear at first glance what is meant by each practice, to make it even easier for you.

### 3.2 Treat Undergraduate Research as Project Management

We should not forget that undergraduate research projects are not only research, but they are projects, too. So, the same rules will apply to them as to other projects, for example the following two important ones:

1. You can, may and should adapt your action during the project process due to new findings (formative assessment).
2. Each project has a set beginning, and it has a set ending.

Laursen et al. (2010) identified four characteristics of a good UR project:

- a. “Must start at a theoretical level that undergraduates are capable of understanding, given their year in school and course background”;
- b. “Must draw on skills that students already possess or can learn quickly enough, to give them a chance to progress in the time available”;
- c. “Should have a modest scope that can be either simplified or extended”;
- d. “Should have a good chance of producing results within the time frame available” (p. 148).

Considering all this, we have two different tasks while guiding and supporting students during their research process:

1. the didactic design of learning processes and their support
2. the teaching of project management and project monitoring skills



Write in your ePortfolio and discuss in your group or with others:

What do you do specifically as a mentor? Which activities do you do to support your students? Please collect your mentoring activities using the phase model by Tremp & Hildbrand (2012).

► Read Chapter 4. Read the provided literature. Complete the activities and writing tasks.

## 4. Mentoring with digital tools

❖ How can we use digital tools in a helpful way for mentoring the Undergraduate Research process?

The aim of this self-learning course is to support you in developing digital competences and skills with regard to providing students support by using digital tools. So now we are looking for digital tools with which you can support the mentoring process. As mentioned above, primarily, you need tools that enhance collaboration and communication, either between the students or between students and mentor.

Which of the mentoring activities you have worked on can also be implemented online? Which tools could be used, which tools may be helpful for your students to support and improve their research activities? And: is going digital always the right choice at all? In which cases not?

Naturally, there is not only one tool for everything, and at the same time one tool may be convenient resp. suitable for the one person but not for the other. Maybe the tools that you like best as an educator are not the ones your students are ready to use, and maybe no tool is exactly the one you would like to have for a specific purpose. Therefore, we use an iterative approach for identifying the tools that are as good and suitable as possible for you and your student groups.



Main activity:

### Digital tools

As you are already an expert as educator and probably have already used digital tools for your teachings, you will benefit from your own expertise.

**1st step:** Collect all digital tools you have already used for your lessons. Design a table to fill in your findings.

This is an example how your table could look like:

Tools					
Nr.	Tool	What is it used for?	Who uses it?	Assessment (1-5 stars)	Comments (intuitive? Good to use for me? For others? etc.)
1					
2					
...					

**2nd step:** Apply suitable tags concerning the kind of tool: “brainstorming”, “reflection”, “feedback”, “time management” etc. Furthermore, apply tags about who uses the tool (only students / students and teachers / only one person / a tool for collaboration) and about how useful it has been according to our earlier experiences. If more tags/ categories are needed, apply even more without hesitation!

**3rd step:** Assign the tools to the different phases of the research process, based on the system according to Tremp & Hildbrand (2012).

This is an example how another table could look like:

Example:

Phase in the research process (e.g. Phase 1 “Develop a research question”)				
Nr.	Students' activities	Teacher's activities	Suggested tools	Comments
1				
2				
...				

If you have a study-group, it might be useful to work together on that task as a project group. Organize yourself and decide which tool you use to document and reflect your decisions and your progress together.



Write in your ePortfolio and discuss in your group or with others:

Write a short summary about your findings and reflections while working on the tasks described above.

Write a short reflection. Key questions: Benefits and limitations of using digital tools. What is easy for me, what is not easy for me? What could be “my way”?

► Read Chapter 5. Read the provided literature. Complete the activities and writing tasks.

## 5. Best Practices



Discuss with your study-group or with others:

### What can we learn through Best Practice Examples?

These are some interesting examples for Best Practice:

- As an introduction, this editorial article of an ebook about Best Practices in Undergraduate Research may serve well:  
<https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01878/full> [15/02/2023]
- If you want to dive further into the topic, you can find more about it in the whole ebook: Giuliano, T.A., Skorinko, J.L.M. & Fallon, M. (2019): Engaging Undergraduates in Publishable Research: Best Practices. <https://www.frontiersin.org/research-topics/8637/engaging-undergraduates-in-publishable-research-best-practices> [15/02/2023]
- You might also read Nancy Hensel (2012): Characteristics of Excellence in Undergraduate Research. [www.cur.org/assets/1/23/COEUR\\_final.pdf](http://www.cur.org/assets/1/23/COEUR_final.pdf) [15/02/2023]
- And last but not least, here you find some “Featured Undergraduate Research Stories” on the CUR Website (<https://www.cur.org>):



Call to Action - please post in your ePortfolio and discuss in your group or with others:

Transfer what you have read into your own life: What must happen for you to think of your students and yourself as Best Practices? What could you do to enhance professionalization both of yourself and of your students in the future?

► Reflect what you have learned in the past weeks. If you have a study-group, discuss your results with them.

## 6. Lessons Learned & “Call to Action“

- ❖ What are your first steps towards integrating the “lessons learned” into your everyday working life?

This chapter is about summing up what you have learned so far and how you can benefit from this course in your working life. So please reflect:



Write in your ePortfolio and discuss in your study-group or with others:

1) Please reflect:

What do I gain from the course? What do I want to use in the future? What do I need to be able to implement what I have learned? What are my first steps towards integrating what I have learned into everyday life? What of all the things I have learned really suits me? With whom can I exchange ideas?

2) Choose, decide, explain: Which tools are you planning to use for mentoring your students?

3) Please read the following article:

O. Renn, J. Dolenc, Joachim Schnabl (2019): *Getting digital tools into students' and researchers' workflows*. *Computer Science*.

<https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=2238&context=iatul> [15/02/2023]

Write your reflections about this topic in your ePortfolio, using (some or all of) the following key questions:

How do I learn about new digital tools? Are there already events (as the mentioned coffee lectures) I can use?

How can I try out digital tools? Are there other teachers with whom I can practice?

How is the situation for my students? Are they motivated to use digital tools? Am I motivated?

What could we do about this?



## Your Literature

### ► Your literature for Chapter 1:

Moody, J. (2019): *Why Undergraduate Research matters in college.*

<https://www.usnews.com/education/best-colleges/articles/2019-09-20/why-undergraduate-research-matters-in-college> [15/02/2023]

Madan, C. & Teitge, B. (2013): *The Benefits of Undergraduate Research: The Student's Perspective.* <https://journals.psu.edu/mentor/article/view/61274/60907> [15/02/2023]

Wang, S. (2019): *A student's guide to undergraduate research.*

<https://www.nature.com/articles/d41586-019-00871-x> [15/02/2023]

Muckel, P., Heidkamp, B. & Brunner, S. (2012): *Learning Scenarios with Integrated ePortfolios. EPortfolios are Nice to have but do Cause Inconvenience. = conference paper: ePiC 2012, p. 238 - 244.* <https://epic.openrecognition.org/proceedings/2012-2/> [15/02/2023]

Kinkead, Joyce (2012): "What's in a Name? A Brief History of Undergraduate Research", *CUR Quarterly*, Vol. 33 Iss. 1 (2012) Available at:

<https://www.cur.org/assets/1/7/331Fall12KinkeadWeb.pdf> [15/02/2023]

### ► Your literature for Chapter 2:

Center for engaged learning: *Undergraduate Research.*

<https://www.centerforengagedlearning.org/resources/undergraduate-research> [15/02/2023]

Pedaste, M.; Mäeots, M.; Siiman, Leo A.; de Jong, T.; van Riesen, S.A.N.; Kamp, E.T.; Manoli, C. C.; Zacharia, Z. C. & Tsourlidaki, E. (2015): *Phases of inquiry-based learning: Definitions and the inquiry cycle*, *Educational Research Review*, Volume 14, February 2015, Pages 47-61. Available at: <https://www.sciencedirect.com/science/article/pii/S1747938X15000068> [15/02/2023]

Tremp, Peter & Hildbrand, Thomas (2012): *Forschungsorientiertes Studium – universitäre Lehre: Das «Zürcher Framework» zur Verknüpfung von Lehre und Forschung.* In Brinker, T. & Tremp, P. (Hrsg.): *Einführung in die Studiengangentwicklung.* Bielefeld: Bertelsmann Verlag. S. 101-116

Gotzen, S.; Beyerlin, S. & Gels, A. (2015): *Steckbrief Forschendes Lernen.* Licensed under Creative Commons Attribution 4.0 International Licence (CC BY 4.0). Available at [https://www.th-koeln.de/mam/downloads/deutsch/hochschule/profil/lehre/steckbrief\\_forschendes\\_lernen.pdf](https://www.th-koeln.de/mam/downloads/deutsch/hochschule/profil/lehre/steckbrief_forschendes_lernen.pdf) [15/02/2023]

Leitungsteam des Projektes *Forschungsbasiertes Lernen im Fokus (FLiF)* (2017):

*Grundlagenpapier Forschendes Lernen der Universität Oldenburg.*

[https://uol.de/fileadmin/user\\_upload/lehre/flif/forschen-at-studium\\_Grundlagenpapier-2017\\_print.pdf](https://uol.de/fileadmin/user_upload/lehre/flif/forschen-at-studium_Grundlagenpapier-2017_print.pdf) [15/02/2023]

Webseite „Forschendes Lernen“ der *Hochschuldidaktik* der Universität Oldenburg:

<https://uol.de/lehre/hochschuldidaktik/forschendes-lernen> [15/02/2023]

### ► Further literature for Chapter 2:

Walkington, H. *Students as researchers: Supporting undergraduate research in the disciplines in higher education.*

[https://www.heacademy.ac.uk/system/files/resources/Students%20as%20researchers\\_1.pdf](https://www.heacademy.ac.uk/system/files/resources/Students%20as%20researchers_1.pdf)

[15/02/2023]

### ► Your literature for Chapter 3:

Shanahan, J. O.; Ackley-Holbrook, E.; Hall, E.; Stewart, K. & Walkington, H. (2015): Ten Salient Practices of Undergraduate Research Mentors: A Review of the Literature, *Mentoring & Tutoring: Partnership in Learning*. DOI: 10.1080/13611267.2015.1126162. Available at:

[https://www.researchgate.net/publication/288669886\\_Ten\\_Salient\\_Practices\\_of\\_Undergraduate\\_Research\\_Mentors\\_A\\_Review\\_of\\_the\\_LiteratureCenter\\_for\\_engaged\\_learning:\\_Undergraduate\\_Research](https://www.researchgate.net/publication/288669886_Ten_Salient_Practices_of_Undergraduate_Research_Mentors_A_Review_of_the_LiteratureCenter_for_engaged_learning:_Undergraduate_Research). [15/02/2023]

Laursen, S., Hunter, A., Seymour, E., Thiry, H., & Melton, G. (2010). *Undergraduate research in the sciences: Engaging students in real science*. San Francisco, CA: Josey-Bass.

### ► Your literature for Chapter 5:

Giuliano, T.A., Skorinko, J.L.M. & Fallon, M. (2019): *Engaging Undergraduates in Publishable Research: Best Practices*. Editorial:

<https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01878/full> [15/02/2023]

Giuliano, T.A., Skorinko, J.L.M. & Fallon, M. (2019): *Engaging Undergraduates in Publishable Research: Best Practices*. <https://www.frontiersin.org/research-topics/8637/engaging-undergraduates-in-publishable-research-best-practices> [15/02/2023]

Hensel, Nancy (2012): *Characteristics of Excellence in Undergraduate Research*. [www.cur.org/assets/1/23/COEUR\\_final.pdf](http://www.cur.org/assets/1/23/COEUR_final.pdf) [15/02/2023]

“Featured Undergraduate Research Stories” on the CUR Website <https://www.cur.org> [15/02/2023]

### ► Your literature for Chapter 6:

O. Renn, J. Dolenc, Joachim Schnabl (2019): *Getting digital tools into students' and researchers' workflows*. *Computer Science*.

<https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=2238&context=iatul> [15/02/2023]

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