



Research Data Management and Higher Education in Physics

J. Bode^{1,2}, P. Jaeger^{2,3,4}

¹ Westfälische Wilhelms-Universität Münster, Germany

² Zusammenkunft aller Physikfachschaften, Frankfurt, Germany

³ University of Manitoba, Canada

⁴ Bergische Universität Wuppertal, Germany

DPG autumnly Spring Meeting (AGI 2.4)
September 28, 2021

Outline

- 1 Introduction
- 2 Students' Perspectives
- 3 Integration in Curricula
- 4 Example: Lab Courses
- 5 Conclusion

Introduction

ZaPF - Federal Conference of Physics Student Councils

- ZaPF = Zusammenkunft aller deutschsprachigen Physik-Fachschaften
- Conferences take place once per semester
- About **40-60 participating** student councils¹
- Higher education politics and **study-related** topics

¹in less insane times



Introduction

ZaPF - Federal Conference of Physics Student Councils

- ZaPF = Zusammenkunft aller deutschsprachigen Physik-Fachschaften
- Conferences take place once per semester
- About **40-60 participating** student councils¹
- Higher education politics and **study-related** topics
 - CHE advisory board for physics
 - “Studienreformforum” in collaboration with DPG (FV Didaktik)
 - Representatives at KFP
 - Student experts in accreditation
- Close collaboration with jDPG

¹in less insane times



Introduction

Why are students talking about NFDI?

MEINUNG

Meine
Meinung

Forschungsdaten effizient managen

Gutes Datenmanagement unterstützt die Forschung und schafft Mehrwerte für die Wissenschaft.

Holger Frahm

Forschungsdaten sind wichtige Grundlage und wesentlicher Output unserer Arbeit zugleich. Nicht umsonst gehören ihre Dokumentation und sichere Archivierung zur guten wissenschaftlichen Praxis. In Kollaborationen teilen wir unsere Daten mit Kolleginnen und Kollegen, um gemeinsam zu neuen Erkenntnissen zu gelangen. Damit alle Beteiligten mit den Daten arbeiten können, vereinbaren wir Standards für ihr Format und die Pflege von Metadaten. Ein Mehrwert solcher Regeln zeigt sich oft erst im Nachhinein,



Prof. Dr. Holger Frahm,
Professor für Theoretische Physik
und Chief Information Officer an
der Leibniz Universität Hannover

- Wir haben die einzigartige Chance, ein Portfolio an nachhaltigen Datendiensten aufzubauen, das unsere Forschung optimal unterstützt.
- *We have the unique opportunity to design a set of data services which optimally supports our research.*

H. Frahm, Physikjournal **18**, 3 (2019)

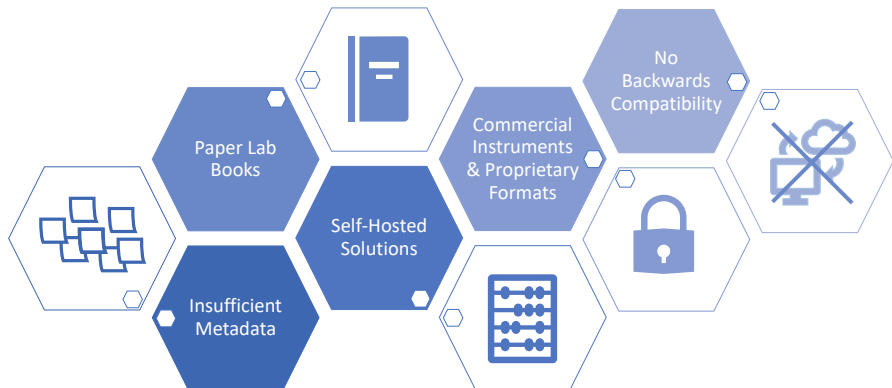
Students' Perspectives

Initial Concerns and Ideas



Students' Perspectives

Status Quo



e.g. *Hochschulforum Digitalisierung*, Diskussionspapier 9, (2020)

Students' Perspectives

RDM and Open Science: The O in FAIR

- Access should be **as open as possible**, open licenses (such as CC-0, CC-BY, CC-BY-SA) should be used.
- Exceptions to **protect unpublished data** etc. are possible.
- Data transparency is a chance for popular science and outreach activities.
- Non-university and for-profit research should be included as much as possible.



Badges by Centre for Open Science

ZaPF, Positionspapier NFDI **Freiburg**, (2019).
DOI 10.5281/zenodo.5519045

Students' Perspectives

Services, Security, and Privacy

- FAIR² RDM systems should provide:
 - version control, high availability, continuous integration
 - contact and calendar management, publication
 - collaboration tools: messenger, video conferencing, ...
- User friendliness and security of the interface should be **audited** on a regular basis

²Findable, Accessible, Interoperable, Reusable

Wilkinson, M. et al., *Sci Data* **3**, 160018 (2016). DOI 10.1038/sdata.2016.18

Students' Perspectives

Services, Security, and Privacy

- FAIR² RDM systems should provide:
 - version control, high availability, continuous integration
 - contact and calendar management, publication
 - collaboration tools: messenger, video conferencing, ...
- User friendliness and security of the interface should be **audited** on a regular basis
- **CIA triad**: Confidentiality (where necessary), Integrity, Authenticity
- Generate **PIDs**³ for all objects in the repository automatically

²Findable, Accessible, Interoperable, Reusable

Wilkinson, M. et al., *Sci Data* **3**, 160018 (2016). DOI 10.1038/sdata.2016.18

³*J. Philipson*, *Data Science* **2**, 229 (2019). DOI 10.3233/DS-190024

Students' Perspectives

Qualification Objectives



ZaPF, Positionspapier FDM im Studium **Rostock**, (2021).
DOI 10.5281/zenodo.5519029

Students' Perspectives

Qualification Objectives



- Degree levels specified in EQF⁴: students work increasingly independently
- Qualification profiles of degree programmes (*Qualifikationsprofile*)
- Guiding principles for research and teaching (*Leitbilder*)

ZaPF, Positionspapier FDM im Studium **Rostock**, (2021).
DOI 10.5281/zenodo.5519029

⁴European Qualification Framework,
European Council, Official Journal , 2017/C 189/03 (2017)

Integration in Curricula

Refine Community Needs



Step by step introduction into FAIR
use of data and metadata

ZaPF, Positionspapier Open Science im Praktikum **Garching**, (2020).
DOI 10.5281/zenodo.5519037

Integration in Curricula

Refine Community Needs



Step by step introduction into FAIR
use of data and metadata



Repositories: long term
administrated storage of data

ZaPF, Positionspapier Open Science im Praktikum **Garching**, (2020).
DOI 10.5281/zenodo.5519037

Integration in Curricula

Refine Community Needs



Step by step introduction into FAIR
use of data and metadata



Repositories: long term
administrated storage of data



Reuse third party data

ZaPF, Positionspapier Open Science im Praktikum **Garching**, (2020).
DOI 10.5281/zenodo.5519037

Integration in Curricula

Refine Community Needs



Step by step introduction into FAIR use of data and metadata



Repositories: long term administrated storage of data



Reuse third party data



Qualification objectives per degree level: consider future developments

ZaPF, Positionspapier Open Science im Praktikum **Garching**, (2020).
DOI 10.5281/zenodo.5519037

Integration in Curricula

Refine Community Needs



Step by step introduction into FAIR
use of data and metadata



Repositories: long term
administrated storage of data



Reuse third party data



Qualification objectives per degree
level: consider future developments

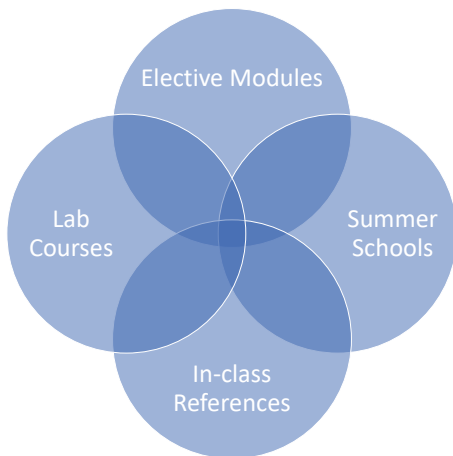


Develop teaching concepts together:
e.g. "Round Table"

ZaPF, Positionspapier Open Science im Praktikum **Garching**, (2020).
DOI 10.5281/zenodo.5519037

Integration in Curricula

Graduate Students and Young Researchers

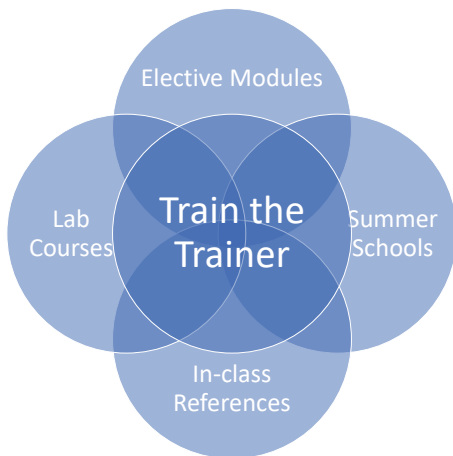


PJ & JB, *Phy. Did. B*, manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Integration in Curricula

Graduate Students and Young Researchers

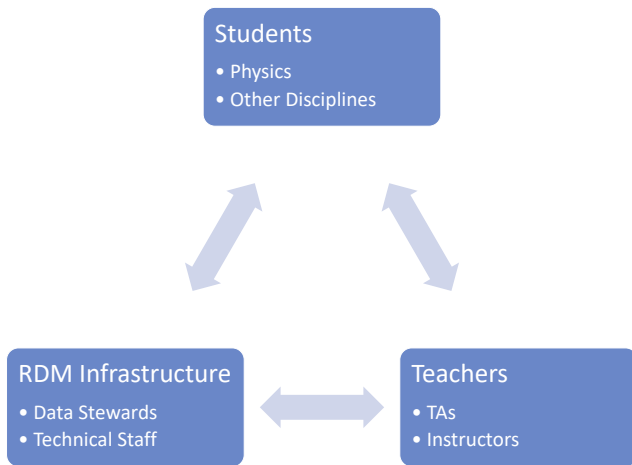


PJ & JB, Phy. Did. B , manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

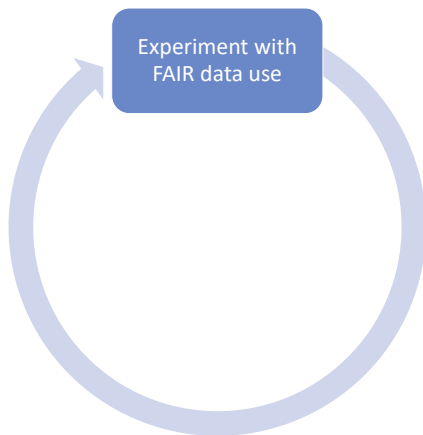
Example: Lab Courses

User Perspectives



Example: Lab Courses

FAIR Data in Student Experiments

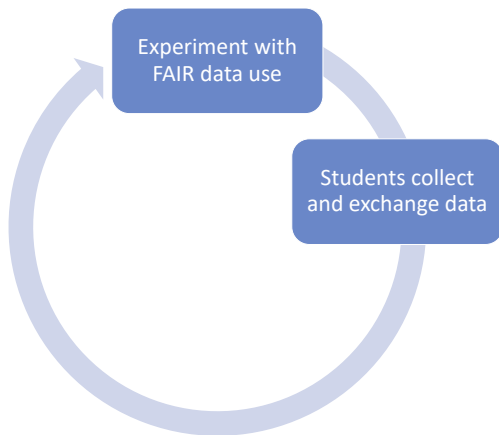


PJ & JB, Phy. Did. B , manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Example: Lab Courses

FAIR Data in Student Experiments

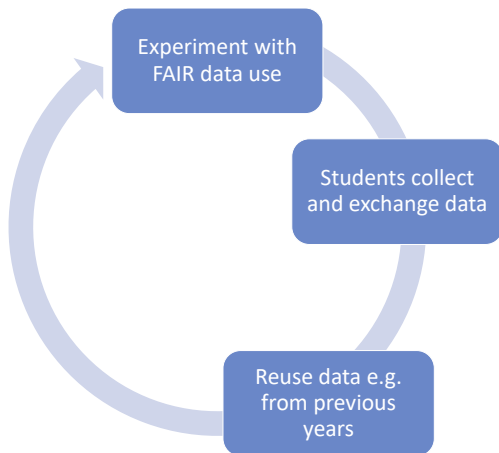


PJ & JB, Phy. Did. B , manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Example: Lab Courses

FAIR Data in Student Experiments

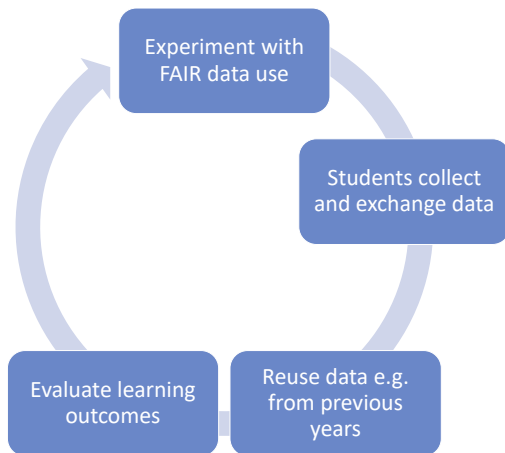


PJ & JB, Phy. Did. B , manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Example: Lab Courses

FAIR Data in Student Experiments

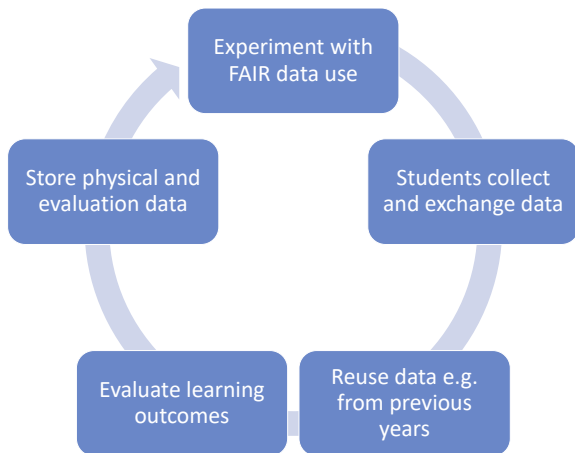


PJ & JB, Phy. Did. B , manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Example: Lab Courses

FAIR Data in Student Experiments

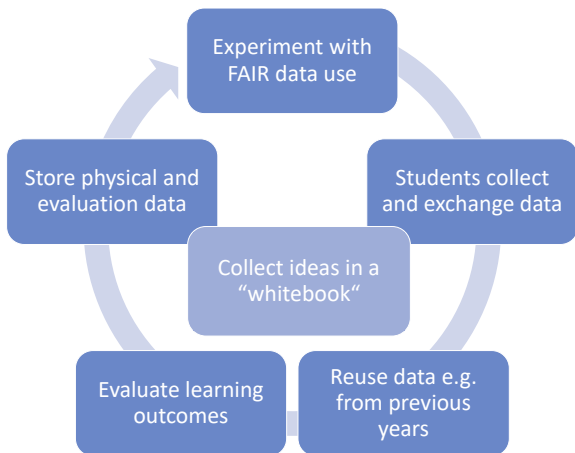


PJ & JB, Phy. Did. B , manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Example: Lab Courses

FAIR Data in Student Experiments



PJ & JB, *Phy. Did. B*, manuscript accepted (2021).

DOI 10.5281/zenodo.5168523

Conclusion

General Aspects of RDM

- Clear policy on **access, privacy, licensing** etc. from the very beginning
- **User friendliness** is paramount
- Implement RDM on the level of **curricula** and qualification objectives

Conclusion

General Aspects of RDM

- Clear policy on **access, privacy, licensing** etc. from the very beginning
- **User friendliness** is paramount
- Implement RDM on the level of **curricula** and qualification objectives

Implementation in higher education

- **Awareness** for a FAIR handling of data
- Students carry knowledge **into their research group** and are able to create understandable data
- Reach a large group of future scientists with **little effort**

Conclusion

Collaborators

- Janice Bode, Uni Münster
<https://orcid.org/0000-0003-1777-9148>
- Philipp Jaeger, U of Manitoba and Uni Wuppertal
<https://orcid.org/0000-0002-7526-1489>
- Merten Dahlkemper, CERN/Uni Göttingen
- Benjamin Wolba, formerly KIT
- Zusammenkunft aller deutschsprachigen Physikfachschaften e.V.
- jDPG, A-Team NFDI
- Collaborating NFDI Consortia

Thank you to our collaborators!