

DALIA,

DALIA4NFDI

**DALIA Platform for Data Literacy Education
and Training Resources**

**Proposal for the Initialisation Phase of Base4NFDI
Submitted: April 23rd, 2025
On behalf of: Section Training & Education**

1 General Information

- Name of proposed Basic Service (in English):
DALIA Platform for Data Literacy Education and Training Resources
- Acronym of the proposed Basic Service:
DALIA4NFDI
- Service "subtitle" explaining key functionality:
An online portal based on semantic web technology by taking advantage of a knowledge graph to promote the learning and teaching of data literacy through the quality-assured supply of content
- Corresponding NFDI Section:
Section Training & Education
- Lead institution:
RWTH Aachen University, Templergraben 55, 52056 Aachen
- Name of lead institution principal investigator:
Prof. Dr. Sonja Herres-Pawlis, sonja.herres-pawlis@ac.rwth-aachen.de
- Participating institutions:

Table 1: List of participating institutions.

Principal Investigator	Institution, location	Contact E-mail	Member in [consortium]	Funding requested [yes no]
Prof. Dr. Sonja Herres-Pawlis	RWTH Aachen University (RWTH-IAC)	sonja.herres-pawlis@ac.rwth-aachen.de	NFDI4Chem	yes
Prof. Dr.-Ing. Peter F. Pelz	Technical University of Darmstadt (TUDa-FST)	peter.pelz@fst.tu-darmstadt.de	NFDI4ING	yes
Prof. Dr. Matthias Müller	RWTH Aachen University (RWTH-ITC)	mueller@itc.rwth-aachen.de	NFDI4Chem	yes
Prof. Dr. Thomas Stäcker	Technical University of Darmstadt (TUDa-ULB)	thomas.staecker@tu-darmstadt.de	NFDI4ING	yes
Prof. Torsten Schrade	Academy of Sciences and Literature Mainz (AWLM)	torsten.schrade@adwmainz.de	NFDI4Culture	no
Prof. Dr. Ulrich Sax	University Medical Center Göttingen (UMG)	ulrich.sax@med.uni-goettingen.de	NFDI4Health	no
Dr. Gábor Kismihók	Technische Informationsbibliothek Hannover (TIB)	gabor.kismihok@tib.eu	NFDI4Culture	no
Axel Klinger	Technische Informationsbibliothek Hannover (TIB)	axel.klinger@tib.eu	NFDI4ING	no

- Planned duration of the project: 1 year
- **Significance:** Empowering people to collect, analyse, evaluate, and use data in a FAIR way requires training in data competencies from the very beginning. Therefore, teaching and training materials must be available according to career level, scientific discipline, and research data management (RDM) level. Every NFDI consortium and RDM initiative needs a means to publish learning resources. As a centralised platform and its embedding into NFDI, DALIA4NFDI can offer better functionality and sustainability than multiple platforms, enabling users to find relevant learning resources through a single point of entry. It provides high-quality recommendations for educational materials, both for lecturers and learners. Consequently, DALIA4NFDI will significantly contribute to increasing data literacy and establishing a data culture in the academic environment and beyond.
- Summary of the proposal in English and German:

English: DALIA4NFDI aims to establish a centralised platform for promoting data literacy and research data management (RDM) through quality-assured, open, accessible teaching and training resources. It emphasises user-centric development by integrating feedback from community workshops, aligning materials with career levels, disciplines, and FAIR data principles.

The platform utilises semantic web technology and a knowledge graph for efficient resource organisation and personalised recommendations. DALIA's technical readiness spans several components, including search functionality (TRL 7) and learning paths (TRL 2). The project leverages the DALIA Interchange Format for metadata standardisation, ensuring interoperability with NFDI knowledge graphs and other services. Key objectives during the initialisation phase include empowering the community, enhancing semantic integration within NFDI, and connecting with other platforms like EOSC. By supporting open collaboration, DALIA4NFDI aligns with the NFDI's goal of harmonising educational efforts across disciplines. Future development focuses on improving features, expanding connections, and ensuring sustainable operations. Through DALIA4NFDI, we envision a robust foundation for fostering data literacy across academia and beyond.

German: DALIA4NFDI zielt darauf ab, eine zentrale Plattform für die Förderung von Datenkompetenz und Forschungsdatenmanagement (FDM) zu schaffen, die qualitativ hochwertige, offen zugängliche Lehr- und Schulungsmaterialien bereitstellt. Der Fokus liegt auf einer nutzerzentrierten Entwicklung, bei der Feedback aus Community-Workshops integriert und Materialien an Karrierestufen, Disziplinen und FAIR-Daten-Prinzipien ausgerichtet werden.

Die Plattform nutzt semantische Webtechnologien und einen Wissensgraphen zur effizienten Organisation von Ressourcen und individuellen Empfehlungen. Der technische Reifegrad (TRL) reicht von ausgereifter Suchfunktionalität (TRL 7) bis hin zu geplanten Lernpfaden (TRL 2). Mit dem DALIA Interchange Format wird eine standardisierte Metadatenstruktur

gewährleistet, die die Interoperabilität mit NFDI-Wissensgraphen und anderen Diensten sicherstellt. Zu den Hauptzielen der Initialisierungsphase gehören die Stärkung der Community, die Verbesserung der semantischen Integration in die NFDI und die Anbindung an Plattformen wie EOSC. Durch offene Zusammenarbeit unterstützt DALIA4NFDI das Ziel der NFDI, den Kompetenzaufbau disziplinübergreifend zu harmonisieren. Zukünftige Entwicklungen konzentrieren sich auf die Erweiterung von Funktionen, die Verknüpfung mit weiteren Diensten und die Sicherstellung eines nachhaltigen Betriebs. Durch DALIA4NFDI soll eine solide Grundlage für die Förderung von Datenkompetenz in der Wissenschaft und darüber hinaus geschaffen werden.

2 State-of-the-Art of Proposed Basic Service

2.1 Background and Motivation

Data literacy for everyone from the very beginning. With this paradigm, we emphasise the importance of education in data literacy (data use, data provision, data management) and demonstrate the way to sustainability in the use and provision of research data. DALIA4NFDI will make a significant contribution to the realisation of the paradigm by integrating the prototype of the DALIA platform¹ into the basic service landscape within the NFDI. The close connection to the NFDI enables strong synergy between the findability, recommendation, and quality assurance of teaching and training materials and the future development of these materials within the framework of the NFDI consortia. A knowledge base can only be successful, i.e. accepted, if, firstly, quality-assessed information, teaching and training materials are available and, secondly, if these materials are offered and recommended according to the particular requirements of the users. Thus, the focus of DALIA is always on the users and their benefits. The DALIA platform acts as a single point of entry, which can suggest materials according to individual requirements in a heterogeneous and constantly growing landscape of information, teaching, and learning materials. Users are primarily individuals from academic and related environments encompassing various roles (lecturers, learner, contributors), different career and RDM experience levels as well as different scientific disciplines. As a result, DALIA assists users with their questions about the use (data science) and provision of FAIR data (FAIR data management), refers to suitable and reliable teaching and training materials, and suggests learning paths and best practice documents. Consequently, as a basic service, the DALIA platform will provide a technical-organisational solution for all NFDI members and their target groups but also the data competency centres and state initiatives. Necessary interactions with other basic services will be described below (cf. sections 4 and 5).

¹ <https://search.dalia.education/>

2.2 State-of-the-Art

Currently, great efforts are being made to identify the requirements for teaching and training materials on the topics of data literacy, and to develop these materials. The most important national and interdisciplinary initiative in this area is the NFDI.² In order to optimise the use of these materials, it is essential that they are easy to find, reusable, and combinable. This requires a single point of entry. However, this leads to a high level of complexity for the platform, as different disciplines, RDM experience levels, and career levels need to be mapped. To solve these problems, there have been numerous efforts in recent years, both nationally and internationally, to collect and analyse teaching and training materials on data literacy, and make them available in the form of online libraries. Some resources focus on specific areas such as the digital humanities or engineering, while others provide generic material.

For general learning materials, three platforms are prominent:

- <https://oersi.org/resources/>
- <https://www.twillo.de/oer/web/>
- <https://www.orca.nrw/oer/oer-finden/oer-suche/>

Further, more specific materials can be found here, among others:

- <https://beta.toolboxdatenkompetenz.de/>
- <https://ki-campus.org>
- <https://tess.elixir-europe.org/>
- <https://www.fairsfair.eu/competence-centre/training-library>
- https://rs.cms.hu-berlin.de/uag_fdm/pages/home.php
- <https://zenodo.org/communities/dcc-rdm-training-materials/search>
- TU9-RDM (2020): https://zenodo.org/communities/rdm_training_engineering_sciences
- DataOne Skill Building Hub: <https://dataoneorg.github.io/Education/>
- SSH Open Marketplace, Training materials:
<https://marketplace.sshopencloud.eu/search?categories=training-material&order=label>
- <https://dmtclearinghouse.esipfed.org/>
- <https://datacarpentry.org/lessons/>
- <https://schoolofdata.org/courses>
- <https://mantra.ed.ac.uk/>
- A small RDM selection: <https://openplato.eu/>
- Digital Humanities: Standardisation Survival Kit: <http://ssk.huma-num.fr/#/>
- <https://programminghistorian.org>
- NFDI related: https://knowledgebase.nfdi4chem.de/knowledge_base,
<https://git.rwthachen.de/nfdi4ing/education>

² Schimmler, Sonja, et al. 2023. Research Data Without Borders: How the Sections of the NFDI Work on Cross-Cutting Topics Across Disciplines and Consortia. *2023 ACM/IEEE Joint Conference on Digital Libraries (JCDL)*, 321–322. DOI: [10.1109/JCDL57899.2023.00078](https://doi.org/10.1109/JCDL57899.2023.00078).

When searching through this huge amount of national and international materials, it is evident that finding suitable content is very difficult. Through DALIA, teaching and training resources are made available semantically, regardless of whether they are used in a workshop, lecture, practical course, or self-study. To this end, the collection of rich metadata of the educational materials is enforced in DALIA and distilled into a knowledge graph.

2.3 Status of Work Results in Preparation for the Basic Service

A cross-disciplinary information model is required for simplifying the process of providing users with suitable materials and making it accessible in a standardised and automated manner. Therefore, the DALIA interchange format (DIF)³ has been developed and is continuously updated. This metadata schema allows the description, linking, and integration of educational resources for the different requirements of career and competence levels and scientific disciplines, in adherence to the FAIR Principles.⁴ Furthermore, it provides a framework to make the metadata comparable and smoothly integrable into the DALIA platform. With the implementation of the DIF into DALIA's infrastructure, the interoperability of teaching and training materials for the DALIA knowledge graph is ensured. In other words, users are able to search for educational resources according to their specific requirements, including career and competence levels as well as scientific disciplines. This unique feature sets the DALIA platform apart from others and was urgently required by many NFDI members. The requirements of the users have been collected by the DALIA team in several community workshops. The information gathered during these networking events was directly incorporated into the development of the DALIA infrastructure. This user-centred development has led to a searching platform that is available to everyone and offers about 500 educational resources in data literacy as of today. The development of this prototype was funded by the Federal Ministry of Education and Research (BMBF) and the funding measure from the EU's Capacity Building and Resilience Facility (funding code: 16DWWQP07). Part of this project, which will end in 2025, are members of the NFDI-consortia NFDI4Ing, NFDI4Chem, NFDI4Culture, and NFDI4Health. By providing the first test environment for the DALIA service, effective connections between these consortia and DALIA were established, which will also lead to support of further developments. Moreover, the consortia have provided numerous metadata of their training materials and gave usability feedback to DALIA. Right now, DALIA is in extensive exchange with GHGA, NFDI-MatWerk, DataPLANT, NFDI4Biodiversity, FAIRagro, and fdm.nrw to include their resources into the knowledge graph via the currently applied manual curation procedure.

³ (a) Geiger, Jonathan, et al. 2024. DALIA Interchange Format (Version 1.3). Zenodo. DOI: [10.5281/zenodo.11521029](https://doi.org/10.5281/zenodo.11521029). (b) Geiger, Jonathan, et al. 2025. Das DALIA Interchange Format – eine Metadaten-Spezifikation für die OER-Plattform DALIA. *DHd 2025 Under Construction (DHd2025)*, Bielefeld, 03.-06.03.25. DOI: [10.5281/zenodo.14944539](https://doi.org/10.5281/zenodo.14944539). (c) Geiger, Jonathan D., et al. 2025. Uniting the Differences with The DALIA Interchange Format (DIF) – a Minimal Metadata Specification for the DALIA OER Platform. *E-Science-Tage 2025*. Heidelberg, 12.-14.03.25. DOI: [10.5281/zenodo.15020137](https://doi.org/10.5281/zenodo.15020137). (d) Steiner, Petra Claudia, et al. 2025. Controlled Vocabularies for a Knowledge Graph on Open Educational Resources. *DH2025 Accessibility & Citizenship*. Lisboa, forthcoming.

⁴ Garcia, Leyla, et al. 2020. Ten simple rules for making training materials FAIR. *PLOS Computational Biology*. DOI: [10.1371/journal.pcbi.1007854](https://doi.org/10.1371/journal.pcbi.1007854).

2.4 Current Technical Readiness Level (TRL) of the Proposed Basic Service

The DALIA service consists of different components (cf. sections 4 and 5) which will have the following TRLs latest at the beginning of the initialisation phase:

Technical:

- Search functionality (as described in 2.3): TRL 7
- Curation form: TRL 2
- User profiles and community pages: TRL 2
- Learning paths and recommendations: TRL 2

Non-technical:

- DALIA Interchange format: equivalent to TRL 5
- Collection of materials: equivalent to TRL 5
- User stories, use cases & personas: equivalent to TRL 3

3 SWOT Analysis

Table 2: SWOT analysis.

Internal	Strengths <ol style="list-style-type: none"> 1. Build on existing infrastructure and user interfaces 2. Team members from various disciplines with in-depth expertise in their fields, including programming and RDM training 3. Team and working procedures well established during the development of DALIA prototype 4. Strong and reliable connections to NFDI, its consortia and sections, as well as internationally (e.g. RDA Focus Group on Learning Outcomes, CODATA, PSDI, ISB) 5. Profound knowledge of requirements from the community 	Weaknesses <ol style="list-style-type: none"> 1. Proposed features cannot be developed 2. Workload of some team members too high 3. Lack of developers
External	Opportunities <ol style="list-style-type: none"> 1. Data literacy for everyone from the very beginning 2. High acceptance through user-centred development 3. Single point of entry to find educational resources for lecturers and learners 4. Categorisation of materials regarding career and competence levels and scientific disciplines 5. Clear commitment of NFDI to teaching and training in data literacy 6. Harmonise educational efforts of all consortia 	Threats <ol style="list-style-type: none"> 1. Awareness too low 2. Consortia use their own environments 3. Heterogeneity of disciplines of NFDI consortia – various requirements 4. Not enough users 5. Lack or low quality of educational resources

Providing DALIA as a basic service will make a significant contribution to realising the paradigm “Data literacy for everyone from the very beginning” (cf. section 2.1). A high level of acceptance and long-term use of the platform is ensured by the strong networking with individual scientific communities, and a project structure based on iterative and user-centred development. This approach will help overcome any issues related to low awareness within the community. Furthermore, collecting requirements from various disciplines and communities allows the target-oriented development, reducing the risk of consortia developing their own separate environments.

Thus, the requirements of the different disciplines are automatically considered, the communities will be empowered to use the platform, and the educational efforts of all consortia will be harmonised. Consequently, more users will be attracted from NFDI and beyond. This, in turn, will enhance the quality of the educational resources. The integration of the DALIA platform as a basic service and the connection of DALIA to other services will create a single point of entry for finding educational resources for both lecturers and learners. To eliminate remaining awareness and usage issues, the performance of the search platform has to be monitored by measurable indicators (KPIs), such as platform usage, or user search behaviour. Monitoring by KPIs should begin after the service is established with its core community features. The risk of these features not being developed is negligible, since the working procedures and dynamics of the DALIA team are well established from the development of the DALIA prototype. This exceptional team structure overcomes communication and coordination challenges and supports the distribution of workload among all team members. Additionally, the great expertise and broad experience of the team members as well as the strong and reliable connections to the NFDI, the consortia, the sections, and international stakeholders serve as a resistant backbone to withstand all weaknesses that might occur during the development phases.

4 Working Concept for the Development of the Basic Service

One of the most important aspects of DALIA is the design of the platform as a single point of entry. This means that existing platforms and materials, or those currently being developed can be linked to the knowledge base via interfaces, while the platform itself refers or forwards to them. In this way, the project contributes to the networking and accessibility of heterogeneous resources, and subject-specific teaching and training materials. The importance and demand for such a central service have been outlined in the preceding sections.

DALIA has agreed on a cooperation with OERSI to avoid redundancy and maximize synergies between the two platforms while keeping the strengths of both. Our plan is to use OERSI's existing search index for automated harvesting while using the DALIA's knowledge graph back-end as a semi-automated source of quality-assured and curated content described with a semantic information model using concepts identified with DALIA's user community. Since OERSI is already harvesting a wide range of sources, DALIA can concentrate on curation and semantic enrichment of OERs and filtering of resources related to digital literacy and research data management within the DALIA's own search interface.

The requirements for developing this service were collected during several community workshops organised by DALIA within the Section EduTrain.⁵ For the design of the first operating prototype of the DALIA search platform, these requirements were implemented, and initial use cases from NFDI consortia were captured (cf. section 2.3). The result was the first operating prototype of the DALIA

⁵ Herres-Pawlis, Sonja, et al. 2022. Sektionskonzept Training & Education zur Einrichtung einer Sektion im Verein Nationale Forschungsdateninfrastruktur (NFDI) e.V. Zenodo. DOI: [10.5281/zenodo.6475541](https://doi.org/10.5281/zenodo.6475541).

platform (Figure 1), the development of which was funded by the BMBF (cf. Section 2.3). This project does not overlap with the herein proposed working programme, it acts as a basis for DALIA4NFDI. The overall task of DALIA4NFDI is now to integrate the platform into the basic service landscape of the NFDI for sustainable operation and to maintain the knowledge base within the community. DALIA4NFDI will stay in permanent contact with the Section EduTrain and their members to serve the entire NFDI according to their requirements. An intensive exchange with the basic service in initialisation RDMTraining4NFDI⁶ will support both services and provide RDMTraining4NFDI with a platform for their resources. Furthermore, DALIA4NFDI will provide a knowledge base for educational resources in data literacy not only for the NFDI, but also for the data competency centres and state initiatives on national level as well as European initiatives, such as the European Open Science Cloud (EOSC).⁷ In fact, the DALIA platform provides an essential open source service that represents an ideal opportunity for the recently launched EOSC EU Node,⁸ and the NFDI Candidate Node in preparation.⁹ To the best of our knowledge, a service with the specifications of DALIA is not available internationally, despite there being significant demand at all levels.



Figure 1: DALIA as a basic service in the national and international environment.

4.1 Service Initialisation Concept

In the initialisation phase, DALIA4NFDI has three main objectives: (1) Empowering the NFDI community, (2) strengthening DALIA's semantic integration within NFDI, and (3) connecting DALIA to NFDI services and beyond. The first objective, empowering the NFDI community, will be achieved by regular networking with the relevant stakeholders from NFDI as well as from data competency

⁶ Müller, Rabea, et al. 2024. Base4NFDI proposal RDMTraining4NFDI - Competence Training for Research Data Management. Zenodo. DOI: [10.5281/zenodo.13310636](https://doi.org/10.5281/zenodo.13310636).

⁷ <https://eosc.eu/>

⁸ <https://open-science-cloud.ec.europa.eu/services>

⁹ <https://eosc.eu/news/2024/11/eosc-tripartite-governance-establishes-process-to-sequence-enrolment-of-candidate-eosc-nodes/>

centres, state initiatives, and others. Initialisation with all 26 consortia is planned to enable and motivate them to bring their own resources into the DALIA knowledge base themselves (increase of TRL for collection of materials from 5 to 7). Therefore, a curation form will be provided to facilitate the semi-automatic digest of resources via a quality-assuring federated curation procedure (increase of TRL from 2 to 5-6). The requirements for this curation form were collected during the development of the DALIA platform in workshops involving participants from across the NFDI and beyond. In addition, the already composed user stories will serve as incubators to establish precise use cases based on the initially shaped user personas¹⁰ (increase of TRL from 3 to 5). Overall, these efforts will be accompanied by community workshops and consortia-specific interviews to summarise essential requirements and use cases across all consortia. The second objective for the initialisation phase of DALIA4NFDI is to strengthen DALIA's semantic integration, especially into the basic service landscape (objective 2). This includes facilitating creation of rich and quality-assured semantic metadata when submitting learning resources, integration of other basic services (increase of TRL for search functionality from 7 to 8), and federation with relevant NFDI knowledge graphs. The well-established network of the DALIA team with the NFDI, its consortia and sections, and beyond will support these efforts, including the evaluation and testing of developed procedures. Most importantly for semantic integration, the DIF must reach a sustainable level to act as a stable basis for the knowledge base (increase of TRL from 5 to 7). Therefore, a DIF metadata schema workshop will be held to align it with existing national standards. The third objective is to examine other potential services to which the DALIA platform could be connected in the future (increase of TRL for search functionality from 7 to 8 and increase of TRL for user profiles and community pages as well as learning paths and recommendations from 2 to 5, respectively). Promising candidates that offer similar or adjacent services to DALIA's functionalities include OERSI,¹¹ twillo,¹² ELIXIR TeSS,¹³ Toolbox Datenkompetenz¹⁴ etc. (cf. section 2.2). Furthermore, Moodle,¹⁵ a learning platform used in educational institutions in 237 countries,¹⁶ has to be taken into account as well. Finally, European initiatives, such as the European Open Science Cloud (EOSC),¹⁷ can carry great opportunities (cf. section 4). Investigating connections to other services is overall worth on the way to sustainable operations of the DALIA search platform.

¹⁰ Petersen, Britta, et al. 2024. Shaping User Personas for NFDI Section Training & Education and DALIA. Manuscript submitted to Bausteine Forschungsdatenmanagement. For reviewing this proposal, a version of the manuscript can be found [here](#).

¹¹ <https://oersi.org/resources/>

¹² <https://www.twillo.de/oer/web/>

¹³ <https://tess.elixir-europe.org/>

¹⁴ <https://beta.toolboxdatenkompetenz.de/>

¹⁵ <https://moodle.org/>

¹⁶ As of January 2025, <https://stats.moodle.org/>

¹⁷ <https://eosc.eu/>

4.2 Development and Integration Outlook

The outcome of the initialisation phase serves as a starting point for further development and integration into the basic service landscape to establish DALIA4NFDI for all consortia. After the initialisation phase, the curation form empowers NFDI users to include materials in the DALIA knowledge base by themselves. This procedure will be supported by user profiles and community pages, which will allow for networking and exchange among the different user groups (lecturer ↔ learner ↔ contributor). Each consortium will be able to include their material in a customisable community page with contact information. In addition to the personalised pages, mapping the collected consortia-specific use cases to all features will ensure user-centric development of the entire platform and offer a user-friendly knowledge base for educational resources in data literacy for all consortia and beyond. Subsequently, additional features can be developed according to the requirements of the users, such as material collections and learning paths for combined and goal-oriented learning, a call for collaboration blackboard, or a basic quiz functionality for example. All features have to be tested in a user-testing procedure. Ongoing materials collection and connection to other services, as described above, will strengthen the DALIA platform to achieve a sustainable business and operation model which has to be explored in detail. Of course, training materials on how to use the DALIA platform have to be provided as well.

4.3 Ramping up for Operation

With a business and operation model that guarantees sustainable operation of the DALIA service, tested features fulfilling the requirements from the community, a reliable metadata schema (DIF), and a strong connection to the community, the service will be ready for a broad audience from all over the NFDI and beyond. It can be used as a single point of entry for education in data literacy following the paradigm “Data literacy for everyone from the very beginning”. Finally, continuous maintenance and user support procedures have to be implemented for ongoing provision of the DALIA platform. Roughly, basic server infrastructure and one person for maintenance and support will suffice to offer the platform in a central operations mode. This will ensure continuous usage and integration in the portfolio of libraries or IT centres of educational institutions.

4.4 Risks and Challenges

The current DALIA prototype provides a reliable basis, minimising risks in the development of DALIA4NFDI. One of the main challenges will be ensuring sustainable operations of the service. How this will be tackled effectively in a targeted manner has been described above. Additionally, low acceptance of the service and reservations against RDM (slow cultural change) have to be taken into account. It can be a demanding challenge to convince people to use the service and contribute their resources to the knowledge base. The risk that the platform does not meet the requirements of the users and their communities was considered from the beginning. Moreover, low quality materials

and misuse can result in limited usage. Furthermore, fulfilling data protection guidelines and other legal requirements could impact the planned schedule.

5 Work Programme

As described above, the initialisation phase of DALIA4NFDI has three main objectives: (1) Empowering the NFDI community, (2) strengthening DALIA's semantic integration within NFDI, and (3) connecting DALIA to NFDI services and beyond. These objectives are transferred into work packages (WPs) for the work programme. RWTH-IAC has the lead over the whole project, while partners are leading individual WPs.

5.1 Overview of Work Packages

Table 3: Overall work programme with work packages, deliverables, milestones, and responsible partners.

Work package	Deliverables (D) and Milestones (M)	Responsible partner	Related work packages
WP1: Empowering the NFDI community	D1.1: Outreach and engagement plan. D1.2: Requirements and use cases: Development / co-creation based on community work-shops and consortia-specific interviews. D1.3: Integration of learning outcome concepts. D1.4: Integration of educational resources of other basic services. M1.1: Federated curation: Release of curation form to facilitate a quality assuring procedure. M1.2: NFDI use cases based on the DALIA user personas established.	Lead: TUDa-FST Partner: RWTH-ITC, RWTH-IAC, TUDa-ULB Support: Project partners without funding (cf. Table 1)	
WP2: Strengthening the semantic integration of DALIA in NFDI	D2.1: Support federated curation: Facilitate submission of quality-assured metadata. D2.2: Evaluation and enhancement of the DIF. D2.3: Semantic interoperability to other basic services. D2.4: Federation with NFDI knowledge graphs. M2.1: Sustainable DIF to act as a stable basis for the knowledge base. M2.2: Evaluation and testing of developed procedures and reporting.	Lead: TUDa-ULB Partner: RWTH-IAC, RWTH-ITC, TUDa-FST Support: Project partners without funding (cf. Table 1)	
WP3: Further connecting DALIA to NFDI services and beyond	D3.1: Based on the use cases developed in M1.2 examination of other potential services that offer similar or adjacent services to DALIA's functionalities. D3.2: Examination of linking DALIA to the Moodle technology. M3.1: Overview of examined other services and selection of suitable candidates for the sustainable operation of the DALIA search platform. M3.2: Connections built to EOSC.	Lead: RWTH-ITC Partner: TUDa-FST, TUDa-ULB, RWTH-IAC Support: Project partners without funding (cf. Table 1)	

Service design.							3					
Service prototype.								4				
Piloting and testing.											5	
Presentation of results.												6
NFDI outreach activities.												7

5.2.1 WP1: Empowering the NFDI community

Distribution of person months: Lead: TUDa-FST: 4 PM
 Partner: RWTH-ITC: 3 PM
 RWTH-IAC: 3 PM
 TUDa-ULB: 1 PM

In WP1, regular networking with relevant stakeholders from NFDI as well as from data competency centres, state initiatives, and others will be established (**D1.1**) and continued throughout the entire initialisation phase. For further engagement, initialisation with all 26 consortia is planned to motivate and enable members of NFDI to contribute their own educational resources to the DALIA knowledge base, including call for materials and support. This will be accompanied by the conceptualisation of a curation form (**M1.1**) which will be the starting point in the federated curation procedure. The technical requirements for this process were identified during the development of the current DALIA prototype in workshops involving participants from the NFDI and external stakeholders. For the admission of newly added resources, a quality-assuring procedure will be established to reduce risks of misuse of the platform: NFDI consortia, RDM initiatives and other developers of educational resources ensure the content-wise curation (federated curation). Automatisation of the metadata curation part will then lead to a semi-automatic admission of resources into the knowledge base. In addition, online community workshops and consortia-specific interviews will be held to collect requirements and user stories across all consortia. Compiling this information will lead to a summary of essential requirements and use cases from the NFDI (**D1.2**). The integration of learning outcome concepts, such as the learning objective matrix,¹⁸ plays a crucial role in reflecting the user requirements within the search platform, enabling the provision of learning paths, for example (**D1.3**). Moreover, other basic services will have training materials on their service, integration of these might cause additional use cases (**D1.4**). Combining all these efforts with the already composed user stories that will serve as incubators, exemplary NFDI use cases based on the initially shaped user personas (lecturer, learner, contributor)¹⁹ will be established (**M1.2**).

¹⁸ Petersen, Britta, et al. 2025. Lernzielmatrix zum Themenbereich Forschungsdatenmanagement (FDM). Version 3. Zenodo. DOI: [10.5281/zenodo.15025246](https://doi.org/10.5281/zenodo.15025246).

¹⁹ Britta Petersen, et al. 2024. Shaping User Personas for NFDI Section Training & Education and DALIA. Manuscript submitted to Bausteine FDM. For reviewing this proposal, a version of the manuscript can be found [here](#).

5.2.2 WP2: Strengthening the semantic integration of DALIA in NFDI

Distribution of person months:	Lead:	TUDa-ULB: 6 PM
	Partner:	RWTH-IAC: 3 PM
		RWTH-ITC: 2 PM
		TUDa-FST: 2 PM

In WP2, the DALIA platform must be prepared for further integration into the basic service landscape on the semantic level, which involves several aspects. As a prerequisite for enabling easy and quality-assured submission of learning resources to DALIA, we will develop metadata profiles based on SHACL²⁰ that enable users to enter semantic metadata with controlled terms via an easy-to-use entry form. The profiles will be published on NFDI4ING's Metadata Profile Service²¹ to increase their visibility and reuse in other applications (**D2.1**). The DIF metadata schema will be evaluated based on user feedback (RFC and workshop) to identify gaps in the current version and to harmonise it with all use cases (**D2.2**). Including the results of this workshop and further optimisation will lead to a sustainable level of the DIF acting as a stable basis for the knowledge base (**M2.1**) which is crucial for long-term semantic integration. Furthermore, compatibility with other relevant basic services through integration, for example with their running incubators, such as IAM4NFDI,²² TS4NFDI,²³ PID4NFDI,²⁴ DMP4NFDI,²⁵ KGI4NFDI²⁶, and Jupyter4NFDI²⁷ (**D2.3**), and federation with relevant NFDI knowledge graphs (**D2.4**) will prepare the DALIA platform for integration into the basic service landscape. The well-established network of the DALIA team within the NFDI, its consortia and sections, and beyond will support these efforts, including the evaluation and testing of developed procedures with suitable testing candidates from across the NFDI (**M2.2**). Actual learners and student alpha testers have already been and will be continuously included for usability testing. Documentation and reporting will complete this work package, including the development of KPIs.

5.2.3 WP3: Further connecting DALIA to NFDI services and beyond

Distribution of person months:	Lead:	RWTH-ITC: 4 PM
	Partner:	TUDa-FST: 3 PM
		TUDa-ULB: 2 PM
		RWTH-IAC: 2 PM

²⁰ Knublauch, Holger & Dimitris Kontokostas, ed. 2017. Shapes Constraint Language (SHACL). W3C Recommendation 20 July 2017. <https://www.w3.org/TR/2017/REC-shacl-20170720/>.

²¹ <https://profiles.nfdi4ing.de/>

²² <https://base4nfdi.de/projects/iam4nfdi>

²³ <https://base4nfdi.de/projects/ts4nfdi>

²⁴ <https://base4nfdi.de/projects/pid4nfdi>

²⁵ <https://base4nfdi.de/projects/dmp4nfdi>

²⁶ <https://base4nfdi.de/projects/kgi4nfdi>

²⁷ <https://base4nfdi.de/projects/jupyter4nfdi>

In WP3, other potential services to which the DALIA platform could be connected to in the future will be examined (based on the use cases developed in M1.2). This is closely in line with the current overall strategy of the NFDI association for 2025/2026 where the strengthening of competencies through inclusion of learning offers from third parties according to NFDI criteria is a major aim.²⁸ Promising candidates that offer similar or adjacent services to DALIA's functionalities are twillo,²⁹ ELIXIR TeSS,³⁰ Toolbox Datenkompetenz³¹ etc. (**D3.1**). Examining a potential linkage of the DALIA platform to the Moodle³² technology (**D3.2**) will increase visibility and user-friendliness, especially when it comes to integrating data literacy into the curricula at the partner institutions of NFDI consortia in higher education. Overall, this will lead to an enhancement of our DALIA4NFDI service by tying it to other NFDI services and will advance the selection of suitable candidates for the sustainable operation of the DALIA search platform (**M3.1**). Here, we will evaluate potential sustainable operations models with TIB (see LoCs by TIB). This WP will be completed by building connections to the EOSC (**M3.2**, cf. section 4) providing additional opportunities for sustainable operations.

5.2.4 WPBase: Mandatory deliverables from Task Area 1 (Base4NFDI)

Distribution of person months:	Lead:	RWTH-IAC: 1 PM
	Partner:	TUDa-ULB: 0 PM
		TUDa-FST: 0 PM
		RWTH-ITC: 0 PM

As stated above, RWTH-IAC has the lead over the whole project, while responsibilities include project coordination, reporting and providing mandatory deliverables from Task Area 1 of Base4NFDI. The reports themselves are embedded in **WP1** through **WP3**. A report with a summary of the requirements analysis (**D.TA1.1**) will be compiled from the results of **WP1**, mostly **D1.3** and **M1.2**. The evaluation report of existing tools and software (**D.TA1.2**) will result from **WP3** (**D3.1** and **M3.1**). The service design and the prototype were initially developed in a project funded by BMBF (cf. section 2.3), however, they are significantly extended by **M1.2** and **M2.1** (documentation: **D.TA1.3**) as well as **M1.1** and **M2.1** (**D.TA1.4**). Testing of the basic service with selected users is integrated in **WP2** (**D.TA1.5**). Since DALIA is already heavily involved in the Section EduTrain, presentations of results and freshly developed features of the service are regularly contributed to the section meetings (**D.TA1.6**). Reporting will also involve presentations as part of NFDI outreach activities (**D.TA1.7**), such as the Base4NFDI User Conference, the NFDITalk Series, and the Services Roadshow by Base4NFDI.

²⁸ Nationale Forschungsdaten Infrastruktur (NFDI) e.V. 2024. Strategy of the NFDI Association 2025/26. https://cloud.nfdi.de/d/e050d154aa334b14aa3f/files/?p=Strategy-20252026_eng.pdf.

²⁹ <https://www.twillo.de/oer/web/>

³⁰ <https://tess.elixir-europe.org/>

³¹ <https://beta.toolboxdatenkompetenz.de/>

³² <https://moodle.org/>

Appendix

Bibliography and list of references

The sources provided by members of the participating institutions are highlighted in bold letters.

Albertoni, Riccardo; Browning, David; Cox, Simon J. D., Gonzalez Beltran, Alejandra; Perego, Andrea, Winstanley, Peter. ed. 2024. Data Catalog Vocabulary (DCAT) - Version 3. W3C Recommendation 22 August 2024. <https://www.w3.org/TR/vocab-dcat-3/>.

Barker, Phil und Stuart Sutton. ed. 2022. LRMI Terms (RDF) 2022-06-14. https://www.dublincore.org/specifications/lrmi/lrmi_terms/2022-06-14/.

Biernacka, Katarzyna, Sarah Ann Danker, Claudia Engelhardt, Kerstin Helbig, Sonja Hendriks, Juliane Jacob et al. 2020. Metadatenchema für Schulungsmaterialien zum Thema Forschungsdatenmanagement: Zenodo. DOI: [10.5281/zenodo.3760398](https://doi.org/10.5281/zenodo.3760398).

Biernacka, Katarzyna, Claudia Haase, Barbara Löhde, Jorge Murcia Serra, Janna Neumann, Pascal Scherreiks, Carsten Schneemann, Hermann Schranzhofer, Matthias Senft, Anne Voigt und Cord Wiljes. 2025. Metadatenchema für Schulungsmaterialien zum Thema Forschungsdatenmanagement. DOI: [10.5281/zenodo.14800610](https://doi.org/10.5281/zenodo.14800610).

Coyle, Karen, ed. 2022. Elements for DC Tabular Application Profiles. In collaboration with Tom Baker, Phil Barker, John Huck, and Nishad Thalath. <https://www.dublincore.org/specifications/dctap/elements/>.

DataCite Metadata Working Group. 2024. DataCite Metadata Schema Documentation for the Publication and Citation of Research Data and Other Research Outputs — DataCite Metadata Schema 4.6 documentation. DOI: [10.14454/mzv1-5b55](https://doi.org/10.14454/mzv1-5b55).

DFG - Deutsche Forschungsgemeinschaft. 60.12 - Personalmittelsätze der DFG. Accessed January 21, 2025. <https://www.dfg.de/de/formulare-60-12-246894>.

Garcia, Leyla, Bérénice Batut, Melissa L. Burke, Mateusz Kuzak, Fotis Psomopoulos, Ricardo Arcila, Teresa K. Attwood, Niall Beard, Denise Carvalho-Silva, Alexandros C. Dimopoulos, Victoria Dominguez Del Angel, Michel Dumontier, Kim T. Gurwitz, Roland Krause, Peter McQuilton, Loredana Le Pera, Sarah L. Morgan, Päivi Rauste, Allegra Via, Pascal Kahlem, Gabriella Rustici, Celia W. G. van Gelder & Patricia M. Palagi. 2020. Ten simple rules for making training materials FAIR. *PLoS computational biology* 16 (5), e1007854. DOI: [10.1371/journal.pcbi.1007854](https://doi.org/10.1371/journal.pcbi.1007854).

Geiger, Jonathan, Abdelmoneim Desouki, Frank Lange, Petra Steiner & Henrika Hüppe. 2025. Das DALIA Interchange Format – eine Metadaten-Spezifikation für die OER-Plattform DALIA. *DHd 2025 Under Construction (DHd2025)*, Bielefeld, Deutschland, 03.-06.03.2025. DOI: [10.5281/zenodo.14944539](https://doi.org/10.5281/zenodo.14944539).

Geiger, Jonathan D., Petra Steiner, Abdelmoneim Amer Desouki, Henrika Maria Hüppe, Frank Lange, Sonja Herres-Pawlis, Alessandra Kuntz, Ulrich Sax & Jochen Ortmeyer. 2025. Uniting the Differences with The DALIA Interchange Format (DIF) – a Minimal Metadata Specification for the DALIA OER Platform. *E-Science-Tage 2025*. Heidelberg, Deutschland 12.-14.03.2025. DOI: [10.5281/zenodo.15020137](https://doi.org/10.5281/zenodo.15020137).

Geiger, Jonathan, Petra Steiner, Abdelmoneim Amer Desouki & Frank Lange. 2024. DALIA Interchange Format (Version 1.3). Zenodo. DOI: [10.5281/zenodo.11521029](https://doi.org/10.5281/zenodo.11521029).

Herres-Pawlis, Sonja, Peter Pelz, Norbert Kockmann, Roger Gläser, Manuela Richter, Johannes Liermann, Jochen Ortmeyer, Ina Heine, Amelie Metzmacher, Ann-Christin Andres, Andreas Münzmay, Jan-Ocko Heuer, Malte Hagener, Jens Dierkes, Cord Wiljes, Birte Lindstädt, Renita Danabalan & John D. Jolliffe. 2022. Sektionskonzept Training & Education zur Einrichtung einer Sektion im Verein Nationale Forschungsdateninfrastruktur (NFDI) e.V. Zenodo. DOI: [10.5281/zenodo.6475541](https://doi.org/10.5281/zenodo.6475541).

Hoebelheinrich, Nancy J., Katarzyna Biernacka, Michelle Brazas, Leyla Jael Castro, Nicola Fiore, Margareta Hellström, et al. 2022. *Recommendations for a minimal metadata set to aid harmonised discovery of learning resources*. DOI: [10.15497/RDA00073](https://doi.org/10.15497/RDA00073).

Knublauch, Holger & Dimitris Kontokostas, ed. 2017. Shapes Constraint Language (SHACL). W3C Recommendation 20 July 2017. <https://www.w3.org/TR/2017/REC-shacl-20170720/>.

Müller, Rabea, Birte Lindstädt, Mirjam Blümm, Justine Vandendorpe & Konrad U. Förstner. 2024. Base4NFDI proposal RDMTraining4NFDI - Competence Training for Research Data Management. Zenodo. DOI: [10.5281/zenodo.13310636](https://doi.org/10.5281/zenodo.13310636).

Nationale Forschungsdaten Infrastruktur (NFDI) e.V. 2024. Strategy of the NFDI Association 2025/26. https://cloud.nfdi.de/d/e050d154aa334b14aa3f/files/?p=Strategy-20252026_eng.pdf.

Ortmeyer, Jochen, Thomas Stäcker, Gábor Kismihók, Matthias Müller, Peter F. Pelz & Sonja Herres-Pawlis. 2024. A Platform for the Provision of Teaching and Training Contents in Data Literacy: DALIA4NFDI. 1st Base4NFDI User Conference (UC4B2024). Fraunhofer FOKUS, Berlin, 11/20/2024. https://events.gwdg.de/event/658/contributions/2390/attachments/793/1654/48_A_Platform_for_the_Provision_of_Teaching_and_Training_Contents_in_Data_Literacy_DALIA4NFDI.pdf.

Petersen, Britta, Canan Hastik, Jan-Michael Haugwitz, Sonja Herres-Pawlis, Konstantin W. Kröckert, Alessandra Kuntz, Janna Neumann, Jochen Ortmeyer, Ulrich Sax, Janosch Schneider, Peter Pelz & Ning Xia. 2024. Shaping User Personas for NFDI Section Training & Education and DALIA. Manuscript submitted to Bausteine Forschungsdatenmanagement. For reviewing this proposal, a version of the manuscript can be found [here](#).

Petersen, Britta, Franziska Altemeier, Sophie Boße, Nina Düvel, Claudia Engelhardt, Mark Fichtner, Canan Hastik, Jan-Michael Haugwitz, Juliane Jacob, Katharina Koch, Alessandra Kuntz, Antje Manske, Andreas Mühlichen, Jorge Murcia Serra, Jochen Ortmeyer, Manuela Richter, Hermann Schranzhofer, Benjamin Slowig, Ute Trautwein-Bruns, Dorothee Urbaum, Anne Voigt, Stephanie Werner, Cord Wiljes & Linda Zollitsch. 2025. Lernzielmatrix zum Themenbereich Forschungsdatenmanagement (FDM). Version 3. Zenodo. DOI: [10.5281/zenodo.15025246](https://doi.org/10.5281/zenodo.15025246).

Pohl, Adrian, Axel Klinger, Boris Hartmann, Carl Schuurbijs, Manuel Kummerländer, Manuel Oellers, Mikey Stengel, Mirjan Hoffmann, Steffen Rörtgen, Stephan Kulla & Tobias Bülte. 2024. Allgemeines Metadatenprofil für Bildungsressourcen (AMB). Entwurf vom 21. November 2024. <https://dini-aq-kim.github.io/amb/draft/>.

Schimmler, Sonja, Franziska Boehm, Michael Diepenbroek, Sonja Herres-Pawlis, Oliver Koepler, Brigitte Mathiak, Peter Pelz & Ulrich Sax. 2023. Research Data Without Borders: How the Sections of the NFDI Work on Cross-Cutting Topics Across Disciplines and Consortia. *2023 ACM/IEEE Joint Conference on Digital Libraries (JCDL)*, 321–322. DOI: [10.1109/JCDL57899.2023.00078](https://doi.org/10.1109/JCDL57899.2023.00078).

Steiner, Petra Claudia, Jonathan Geiger, Frank Lange & Abdelmoneim Amer Desouki. 2025. Controlled Vocabularies for a Knowledge Graph on Open Educational Resources. *DH2025 Accessibility & Citizenship*. Lisboa, Portugal, forthcoming.

Wittenhorst, Tilman. 2024. Base4NFDI - Requirements for Completion of Initialisation Phase. Zenodo. DOI: [10.5281/zenodo.11519611](https://doi.org/10.5281/zenodo.11519611).

Webpages

AIMS. 2025. "Metadata Profile Service." Accessed January 20, 2025. <https://profiles.nfdi4ing.de>.

Base4NFDI. "Base4NFDI Projects." Accessed January 20, 2025. <https://base4nfdi.de/projects>.

BMBF DALIA project. 2025. "MoDALIA Ontology." In collaboration with Abdelmoneim Amer Desouki, Marc Fuhrmans, Petra C. Steiner, Frank Lange." <https://dalia.pages.rwth-aachen.de/dalia-ontology/index-en.html>.

BMBF DALIA project. 2025. "MoDALIA Ontology." In collaboration with Abdelmoneim Amer Desouki, Marc Fuhrmans, Petra C. Steiner and Frank Lange. v1.0.0. <https://purl.org/ontology/modalia#>.

DALIA. 2025. "DALIA Search Portal." <https://search.dalia.education/>.

DALIA. 2025. "Search DALIA, Data Literacy Alliance." <https://zenodo.org/communities/dalia/>.

EOSC Association. "EOSC Association". Accessed January 20, 2025. <https://eosc.eu/>.

EOSC Association. 2024. "EOSC Tripartite Governance establishes process to sequence enrolment of Candidate EOSC Nodes". <https://eosc.eu/news/2024/11/eosc-tripartite-governance-establishes-process-to-sequence-enrolment-of-candidate-eosc-nodes>.

European Open Science Cloud - EU Node. "Available Services". Accessed January 20, 2025. <https://open-science-cloud.ec.europa.eu/services>.

ELIXIR TeSS. "TeSS (Training eSupport System)." Version 1.4.1. Accessed January 20, 2025. <https://tess.elixir-europe.org/>.

Moodle. "Home | Moodle.org." Accessed January 20, 2025. <https://moodle.org/>.

Moodle. 2025. "Home | stats.moodle.org". Accessed January 20, 2025. <https://stats.moodle.org/>.

Toolbox Datenkompetenz. "Toolbox Datenkompetenz." Accessed January 20, 2025. <https://beta.toolboxdatenkompetenz.de/en>.

twillo. "Offene Bildungsmaterialien finden." Accessed January 20, 2025. <https://www.twillo.de/oer/web/>.