

# Possible Application Scenarios for a German National Education Platform

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**Abstract:** In today's knowledge-driven world, the competences of its citizens have turned into one of the most valuable resources a country can build its success upon. Hence, it is of extremely high importance to not only provide high-quality education, but to also make life-long learning as convenient as possible. This is the main idea behind the national education platform the German government intends to establish. With that goal in mind, momentarily, a prototypical implementation is being developed in a project called BIRD. The publication at hand outlines four possible scenarios: classical learning environment, simulation games, extracurricular certifications, digitization of administrative processes. The contribution is therefore twofold, to disseminate the project as well as to provide a basis for discussion that might lead to additional or related scenarios.

## 1 INTRODUCTION

In today's knowledge-driven world, the competences of its citizens have turned into one of the most valuable resources a country can build its success upon (OECD 2012). Therefore, the task of the education systems of countries that have recognized this is to provide citizens, regardless of age and prerequisites, with the best possible opportunities for realizing their potential (van der Wende 2003). Consequently, there is an active scientific sub-community that works on overcoming the related challenges by exploring innovative measures (Bockshecker et al. 2021; Dengel et al. 2021; Häusler et al. 2020; Majuri et al. 2018; Zender et al. 2020). One of the factors that require adaptation is the ongoing digitalization of today's society. As a consequence, the educational sector is also challenged to keep up (Frolova et al. 2020). On the one hand to impart the knowledge to succeed in this environment and on the other hand to utilize new opportunities to improve previously applied teaching methods.

Only when education is made easily accessible, its reach will be maximised, since otherwise many potential recipients will be excluded or deterred (Onyema et al. 2020). Therefore, it is of extremely high importance to not only provide high-quality education, but to also make life-long learning as convenient as possible.

This is the main idea behind the "Nationale Bildungsplattform" (NBP; eng.: "national education platform") the German government intends to establish. With that goal in mind, momentarily, a prototypical implementation is being developed with the purpose of exploring technologies, application scenarios, options and challenges to pave the way for the implementation of the actual productive environment planned for later on. The publication at hand outlines four possible application scenarios to disseminate the project as well as to provide a foundation for corresponding discussions that might also result in the identification of additional or related scenarios.

For this purpose, the remainder of this publication is structured as follows. After this introduction, the platform prototype is introduced. Subsequently, four possible application scenarios are outlined, which is

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followed by a discussion. At the end, an outlook on future perspectives and plans as well as a conclusion are given.

## 2 RELATED PROJECTS

In recent years, several projects have been established to develop solutions for facilitating the digitalization of education. To provide context to the proposed endeavour, in the following, some of those projects are briefly presented.

The development of the „Platform for international student mobility“ (PIM) started in May 2020 and aims to create a platform to provide Higher Educational Institutions (HEI) with applicable solutions to meet the requirements of the German Online Access Act (OZG). The OZG states that federal, state, and local governments need to offer administrative services digitally until the end of 2022 (BMI 2022). Among other things, the platform should enable a workflow for the digitized recognition of student achievements, autonomous management of documents and related processes. Further, interoperability between organizational tools like campus management systems (CMS) shall be achieved (PIM 2020).

PIM interacts with another project called XHigherEducationInstitutionExchange (XHEIE). Like PIM, the goal of XHEIE is based on the OZG and addresses the development of a national data standard to enable the exchange of student data and the interoperability between German CMS (XHEIE 2020). The project is one of several under the umbrella of XBildung, which pursues the standardization of data exchange across the entire education system (XBildung 2021b), not only the tertiary education sector.

Another project called “Digitaler Campus” (eng.: Digital Campus) aims at developing a portal of connected platform services for international students to validate the suitability of student applicants, provide them with information, facilitate recruitment and support their adaptation regarding language, culture, and the subject they want to study (DAAD 2022).

To digitize educational certificates of HEIs in a national and international context, an additional project was established called “Digitale Bildungsnachweise für Hochschulen” (DiBiHo). Based on the work of (Digital Credentials Consortium 2020), a proof of concept for different use cases of German HEIs is desired. These cases include the specification of a reference architecture and a data

model as well as the development of prototypes and models for the operation and support. Further processes for the creation, storage, transfer, verification and revocation of digital educational certificates are elaborated and evaluated (Technische Universität München 2022).

Those previously mentioned projects are using or building upon existing data standards. These comprise, inter alia, the ELMO data standard (EMREX 2020) used in the EMREX Network (EMREX 2022) for the standardized and automated exchange of documents between HEIs in Europe. The standard is considered in any of the previously outlined projects. Further, the EDCI standard is acknowledged by XBildung (XBildung 2021a), PIM (PIM 2020), and DiBiHo (Technische Universität München 2022), as it specifies standardized module information (Europass 2021). Moreover, the World Wide Web Consortium (W3C) is involved in XBildung (XBildung 2021a) and DiBiHo with its Verifiable Credentials Model (W3C 2021b) as well as Decentralized Identifiers (DID) (Technische Universität München 2022; W3C 2021a).

For the final development of the NBP, the results of such projects should be integrated and four projects were established in order to build prototypical implementations of the NBP. In parallel to the project described in the publication at hand, which is one of them, a project called mEDUator is developing a so-called Common Learning Middleware (CLM). The middleware works as a mediator between relevant components of learning management and education ecosystems. This includes user interfaces, authentication systems as well as user and enrolment management. Furthermore, databases for profile and learning data, metadata and learning media should be provided. In addition, various other services can be connected to interoperable interfaces for example for the secure verification of educational records using blockchain technologies (Fraunhofer FOKUS 2021).

Another prototype platform is developed by the project L<sup>3</sup>oop, which pursues the target of central, self-sovereign and lifelong learning for citizens as well as transparency and trust in the utilization of personal data through providers of education (Seidel 2021).

The third project KOLIBRI aims at developing a prototypical platform for the NBP. Its focus is first and foremost the self-sovereignty of its users and their data through a federated and user-centric identity management. In addition, the connection to existing educational offerings as well as opportunities for the collaboration of users through, inter alia, messaging or video conferencing are desired.

### 3 THE PLATFORM PROTOTYPE

The development of the prototypical platform is done in the context of a project called BildungsRaum Digital (BIRD, eng.: Digital Educational Space). There, a diverse set of project partners, including several universities as well as other education-related organizations. In collaboration they aim to explore how the subsequent productive system should be designed to fulfil the overarching goals. In the project, the open-source idea is promoted, which pertains to the output as well as the utilized tools. Further, BIRD acts as an umbrella that is accompanied by a plethora of other projects that explore teaching and learning services that shall be embedded to increase the diversity of the platform.

The requirements for the platform are diverse and relate to various aspects as outlined in the following. Since the German education system is heterogeneous by nature (Holst et al. 2020), this property shall also be reflected in the platform itself. This means, that it is not providing any educational courses by itself, but rather acts as an aggregator that helps with finding and accessing relevant offerings by affiliated education providers based on individual learner's circumstances and preferences. Those, however, are still organized and conducted autonomously via their own learning management system (LMS). Therefore, the platform supports the promotion and ease-of-access, without compromising the different organisations' independence.

To avoid disadvantages and barriers that would arise from separate accounts with each provider, it is, despite the increased technical complexity, further necessary to implement a single sign-on option. This way, the user only needs to remember one set of login data, which increases the ease of use, especially when accessing services of a large number of providers.

In addition, records of learning progress and certificates can be issued as well as requested by the providers. This allows to track and verify learner progress and accomplishments, but also to ensure specific prerequisites for participating in a course (e.g. successful completion of a required course or the proof of necessary language skills).

However, to increase the users' trust and to reduce the potential for abuse, those information shouldn't be centrally stored, which might make them accessible for a large group of people. Consequently, the platform emphasizes the users' data sovereignty by not directly storing personal data, affiliations, certificates and similarly sensitive items. Instead, each user has their own, individually controlled data wallet. From there, they can allow the corresponding

access on a fine-granular basis, determining which recipient sees which individual item(s). To increase accessibility and ease of use, this wallet is, inter alia, provided as a smart phone app, allowing the majority of potential users immediate access at all times.

To facilitate the (potentially cross-organizational) cooperation of learners, the platform provides them with a plethora of tools. This allows, inter alia, the use of video conferencing, chats and messaging, data sharing, separated workspaces, and the use of a shared learning store, including a targeted search, to access additional relevant materials. In this context, it is important to mention the relevance of using Open Educational Resources (OER). This corresponds to the idea of sharing and reusing learning and teaching materials and applications (Butcher 2015).

Moreover, not only the learning itself shall be improved by the platform, but also the administrative processes that accompany the learning journey. This relates, for example, to verifying school transcripts, checking credentials, meeting imposed requirements, or proving affiliation with an organization or institution, which is also required to assure OZG compliance. This reduces the effort for the learners, but also for the institutions involved, shortens the cycle time of the processes implicated, increases security and reliability, and at the same time helps to reduce costs.

While each of those features on their own might already improve the educational user journey, the true benefit lies in their synergy, which allows to strengthen the connection of different educational areas and consequently to increase the flexibility of each individual's learning journey, helping them to work purposefully on the realization of their potential and to achieve their individual goals (Riedel and Berthold 2018).

### 4 THE SCENARIOS

In the following, a set of four scenarios is presented, which together correspond to an exemplary instantiation of the basic functionality of the platform and whose prototypical implementation therefore represents a major step towards productive usability. The first three scenarios are directly related to teaching. Scenarios 1 and 2 cover academic teaching, while scenario 3 deals with further training. The fourth scenario focuses on underlying administrative processes in and between institutions of higher education. As part of the project, an experimental lab (BIRD Lab) is established that will explore and implement those scenarios.

#### 4.1 Scenario 1 – Classical Learning Environment

The first scenario addresses the connection of a classical learning environment to the platform. In a first step, the learner can search the platform for courses of interest and, if successful, register for the chosen course. Subsequently, users have to prove their eligibility. This validation could for example be done by sharing a machine-readable certificate of matriculation provided by their alma mater and stored to their data wallet. After eligibility is confirmed, the course provider creates and delivers an account for the learner. These accounts can be anonymous, as it is often not necessary for the instructor to know more information about the individual. To keep the effort for the learner low, it should still be possible to log in via single sign-on, so that there is no need to remember new account data for each new course. The necessary link between the anonymous account for the course and the account for the platform is managed through the user's digital wallet.

The course material is distributed via the provider's LMS, assuring its full autonomy in terms of content and organization. To support the course delivery, the platform's tools can be utilized, however, this is completely optional. In addition, the instructor can issue individual certificates of achievement (e.g. for successful course completion), which the learner can save to their wallet as a valid proof for additional parties in the future at their own discretion.

As an exemplary case, in the prototype, this scenario will be shown on the basis of an SAP course (SAP 2022b), where students learn how to work with an enterprise resource planning system by fulfilling a number of corresponding tasks in a guided manner. In this particular use case user anonymization is essential, since here, despite the use of single sign-on, the identity of the user should be and remains preserved from SAP as the underlying software provider.

#### 4.2 Scenario 2 – Simulation Game

The second scenario extends the focus to non-classical and more gamified teaching concepts. Yet, instead of each student individually processing a static set of tasks and instructions, they participate in educational games, which they perform cooperatively and potentially also competitively with the intention of increasing engagement and, therefore, also the learning success (Häusler et al. 2021).

Just like the previous scenario, this one starts with searching for a learning service, registering for that

course, and then verifying eligibility. The distribution of user accounts remains the same. However, due to the team-oriented nature of this form of learning, the formation of learning groups is added as an additional step. This can either be done by the lecturer within the framework of a course or self-organized by the learners without the need for an instructor. Subsequently, the simulation game is carried out. Here, learners can take advantage of the variety of teamwork tools offered by the provider's LMS or by the NBP to support collaboration and thus to increase learning success. Once the course is successfully finished, as in the first scenario, the learner can be provided with a certificate that can be saved to their data wallet for future proof.

For the prototype, this scenario will be implemented based on a business simulation game in the ERP context, which builds upon the SAP course used in the first scenario. While the learning environment and the user management are similar, new cooperation tools are added.

#### 4.3 Scenario 3 – Extracurricular Certifications

The third scenario extends the scope of the previous two use cases by separating tasks by service provider, e.g. for course facilitation and course assessment. Furthermore, it is important to acknowledge that some academic courses, continuing education offerings, or certificates come with a fee.

While the learners' course search and the general course administration are similar to the previous two scenarios, metadata management is added to enable the storage and presentation of all relevant information despite the heterogeneity of involved providers and available learning formats. Moreover, to enable billable services, the learner or third-party sponsors shall be able to pay via multiple options, including vouchers. Since the idea of the platform is to create one central point of control for a citizen's learning journey, this shall also be handled by the user's digital wallet. Once the registration and payment are completed, the course execution itself is the same as in the previous scenarios. However, to successfully complete a course, many widely acknowledged qualifications require the learner to pass a certification exam supervised by an authorized institution that may be independent from the educational institution. The same is common for proof of further training, which some occupational groups are obliged to complete periodically. Thus, in this scenario, the instructor and the organisation

invigilating the exam and issuing the certificate are potentially different and independent entities.

For the prototypical implementation it is planned to use the SAP certification TS410 as a professional qualification. Yet, since the involvement of external partners always adds another layer of complexity and, consequently, additional challenges, which are not necessarily relevant for the technical aspects of the implementation, some of the operational steps will possibly be simplified for practical purposes.

#### 4.4 Scenario 4 – Digitization of Administrative Processes

While the first three scenarios were directly related to the learning process, the fourth one focuses on administrative background processes. Although they do not immediately affect the teaching process, they play an essential role in educational administration. This is because they influence the duration, convenience and security of interactions with respective institutions as well as the administrative effort and associated costs in turn.

Yet, this is arguably the most complex of the four scenarios, since historically the corresponding landscape of utilized software solutions is highly heterogeneous. In contrast to larger universities, which already use standardized CMS to streamline administrative processes, other providers such as schools, private universities and non-for-profit organisations still tend to use individual software solutions (Pausder and Becker-Pennrich 2020). Another challenge stems from the fact that possible options for processes that have to be covered are manifold. A non-exhaustive list includes for instance the submission and verification of the baccalaureate certificate for a university application, the proof of required qualifications (e.g. in the form of a language certificate), the transmission of certificates of achievement between different faculties of a university, the administration of courses that are built up from partial achievements of different providers or the issuance of electronically signed certificates of completion.

Within the scope of the prototypical implementation, for the sake of simplification, it is planned to, at least initially, focus on one particular CMS. Therefore, it appears reasonable to choose a widely used CMS to increase representativity, which makes SAP Student Lifecycle Management (SLcM) (SAP 2022a) and HISinOne (HIS eG 2022) the primary candidates. However, the final selection of the CMS as well as the relevant processes to be implemented in the prototype still has to be made.

#### 4.5 Discussion

The opportunities and benefits entailed by the four introduced scenarios are manifold. For scenario 4, this is arguably the most obvious, since the digitization of administrative processes allows to act faster, more resource-efficient, less error-prone, and at the same time reduces the risk for data manipulation. However, the impact of the measures in the other scenarios is also immense. With the integration of the classical learning environments from scenario 1, "true" interoperability of educational offerings as part of a complex learning journey is enabled. While today most courses are carried out by a one single provider, they can possibly be composed from separate units offered by various organizations. Each of them can certify the success in their respective parts of the learning journey and when completed, the entire course is passed and could be documented by a joint certificate. Even though this is already possible in theory, in practice the organizational effort is so high that it is often not a viable option. However, to allow for consecutive courses, besides the purely technical implementation, it will also be necessary to develop standardized metadata structures.

While the classical learning environments are rather geared towards formal education, the simulation games from scenario 2 can not only be embedded in this context, but may also lead to free-of-charge political, social and civic education on various topics, therefore addressing a substantially larger audience and demographic.

To enable the billable certifications via the NBP, as outlined in scenario 3, allows for seamless and trusted integration of academic courses and vocational training as well as sequential cross-organization certification courses.

### 5 OUTLOOK

For the prototype the plan is to implement the first three scenarios in the given order, since they build upon each other. The fourth scenario, on the one hand, is rather independent and its implementation probably the most complicated and time-consuming. Therefore, it will be worked on in parallel. First research and conceptual work will result in *good practices* (due to the novelty of the endeavour, a claim for best practices might be too ambitious) in cooperation with pilot institutions. This includes, inter alia, determining which admin processes to implement first, which requirements are common for education

providers, whether there are reference processes and how they look like, how the metadata should be structured and how the users' data sovereignty can be assured in their own, lifelong BIRD wallet.

The communication between the wallet and eco system other components (e.g. LMS, CMS or the platform itself) will be handled through connectors. Therefore, those have to be provided and maintained by all participating partners. This implementation process needs to be standardized and supported in order to lower the entry barrier for as many partners as possible.

To enable the desired single sign-on functionality, as described in scenario 1, it is planned to persist the login data for all of the individual's course accounts in the user's digital wallet. From there, via the connector of the LMS, it can be used to access the target system seamlessly. For the second scenario, achieving the integration of cooperation tools will be the main challenge. For the third scenario, the payment process needs to be designed and, as mentioned in the corresponding section, it might be necessary to simulate some steps of the overall certification process.

Finally, when looking further into the future, there is also the challenge of putting the project findings together and to productive use, which requires thorough planning, since this is oftentimes a big hurdle in the adoption of research results in the educational space (Bußler et al. 2021).

## 6 CONCLUSION

Education is a powerful resource to maintain and grow a society's wealth. However, besides having high-quality teaching, it is also necessary to make it accessible to as many citizens as possible by lowering the barrier of entry and allowing for individualized learning journeys. For this reason, the German government commissioned a project to explore how a national education platform should be designed and implemented. For this purpose, a prototype is being built. The publication at hand outlines the BIRD Lab's implementation concept of four currently envisioned scenarios for classical learning environments, simulation games, extracurricular certifications, and the digitization of administrative processes. Hereby, the contribution is twofold, on the one hand, the platform and the corresponding project are disseminated in the scientific community and on the other hand, it provides a foundation for corresponding discussions that might possibly also result in the identification of additional or related

scenarios. In the future, the introduced scenarios shall be implemented to the prototype while also exploring and incorporating further improvements and insights that might be discovered in due process. However, since there is a plethora of potential stakeholders this also means that it is not possible to fulfil every single demands gathered. Therefore, the most relevant ones will be identified so that they can be prioritized when the productive national education platform is finally being developed.

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