

Priority Initiative of the Alliance of German Science Organizations

“Paths to digital qualification”

A discussion paper by the Working Group “Digitally qualified staff” (AG 6) in
cooperation with
the Working Group “Digital learning, teaching and networking” (AG 5)¹

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Core message

The digital transformation is one of the greatest challenges currently facing science, business and society. The lack of digitally qualified staff affects all Alliance organizations both acutely and equally. Rapid action is essential if this challenge is to be met. By pooling the strengths of the Alliance organizations it should be possible to find short or long-term solutions aimed at improving the situation for the whole academic system within a reasonable time-frame. Such cooperative solutions would impact the transition from school to university and beyond to include the time spent studying and acquiring qualifications, and continuing through to higher research training. The range of solutions could extend from the exchange of “good practice” examples through to the collective development of a range of offers, formats and strategies. There follows a description of the various challenges facing the academic system, together with details of the skills required to meet them, and the key features involved in the implementation process.

The challenge

Over the past 50 years digital technologies have made increasing inroads into all areas of society, confined initially to a limited number of research fields but currently spreading to include nearly every part of our lives. Digitization has, however, already brought forth new approaches, such as recent developments in the use and analysis of large data sets throughout research. This has made it possible

¹ In the following the focus is on the subject “digital qualifications”. In this paper the Working Group “Digitally qualified staff” of the “Digital Information” priority initiative of the Alliance of German Science Organizations, in cooperation with the Working Group “Digital learning, teaching and networking”, presents the current situation in the field and identifies open challenges as a basis for the requisite discussions and deliberations.

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to pursue new research methods and to raise new questions. Research must now closely follow and shape this development.

However, we must recognize that digital skills are currently lacking throughout German academia - whether we are looking at students, teaching staff, researchers, or ancillary technical and administrative support staff - and this is in spite of the increasing numbers of so-called “digital natives”. This deficit has been steadily increasing over the past few years. In contrast there is an acute demand for digitally qualified staff and specialist expertise, not only in research but in many other areas of society. It is clear that today's multi-perspective (research) approaches require a system of organized interaction between the various disciplines and areas of expertise, with all of these elements receiving equal recognition. This also applies to cooperative projects extending beyond the borders of the scientific organizations. This kind of interaction will need to be organized and communicated within the research and teaching environment.

At the beginning of the 2000s, research organizations began to heed the topics “Digital Literacy” and “Data Literacy”, and to present corresponding concepts. One example of this is the European Reference Framework “Key competences for lifelong learning”², which was adopted by the European Commission in 2006 and in which digital literacy - then still known as “computer literacy” - was held to be of equal value to other achievements, such as mother-tongue language proficiency, basic mathematical and scientific skills, or social competence.³ Following this, the EU published the reference framework “DigComp 2.0”⁴ in 2016, which listed descriptors for the various sub-fields of digital literacy.⁵ The British non-profit organization for the advancement of digital solutions for UK education and research (JISC) has focused intensively on the field of “digital literacy”, and in 2017 published corresponding guidelines on the promotion of this skill in universities and other institutions of further education.⁶ In November 2018 the European Commission published a further paper on the subject under the title “Turning FAIR into reality”⁷, calling for “data science and data stewardship skills”, and the teaching of them, to be incorporated into university education within the existing framework of measures relating to the handling of research data.⁸ In Germany intensive discussion of these matters has only begun in the last few years. In 2016 the Federal Ministry for Education and Research BMBF dealt explicitly with the topic digital literacy in its position paper “Bildungsoffensive für die digitale Wissensgesellschaft” (Education offensive for the digital knowledge society).⁹ A year later the Standing Conference of the Ministers of Education and Cultural Affairs KMK then published the strategy paper “Bildung in der digitalen Welt” (Education in a digital world)¹⁰ which contains action guidelines for the promotion of digital skills, directed at schools and universities. Subsequently the

² Schlüsselkompetenzen für lebenslanges Lernen – ein Europäischer Referenzrahmen. Europäische Kommission, 2006. <http://www.kompetenzrahmen.de/files/europaeischekommission2007de.pdf>

³ Cf. *ibid.* p.3.

⁴ The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model. European Commission, 2016. doi: 10.2791/11517.

⁵ Cf. *ibid.*, p.8 f.

⁶ Building digital capabilities: The six elements defined. JISC, 2017. http://repository.jisc.ac.uk/6611/1/JFL0066F_DIGIGAP_MOD_IND_FRAME.PDF.

⁷ Turning FAIR into reality. Final report and action plan from the European Commission Expert Group on FAIR Data. European Commission, 2018. doi: 10.2777/1524.

⁸ *Ibid.*, p. 46 ff.

⁹ Bildungsoffensive für die digitale Wissensgesellschaft. Strategie des Bundesministeriums für Bildung und Forschung. Bundesministerium für Bildung und Forschung (BMBF), 2016. https://www.bmbf.de/files/Bildungsoffensive_fuer_die_digitale_Wissensgesellschaft.pdf.

¹⁰ Bildung in der digitalen Welt. Strategie der Kultusministerkonferenz. Kultusministerkonferenz, 2017. https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2018/Strategie_Bildung_in_der_digitalen_Welt_idF._vom_07.12.2017.pdf.

Stifterverband (Association of German Science Sponsors) also focused on the subject as part of its Future Skills initiative, presenting its resulting “Future-Skills-Framework”¹¹ in 2018. Most recently the “Rat für Informationsinfrastrukturen” (German Council for Scientific Information Infrastructures)¹² has formulated specific recommendations on career and training prospects for the academic employment market in the paper “Digitale Kompetenzen – dringend gesucht!” (Digital literacy - urgently wanted!)¹³.

The challenges within the academic system are focused on the following issues in particular:

➤ **Digitization is a challenge for everyone**

Increasing digitization challenges not only individuals but also institutions, and indeed the entire academic system. In the context of changing work environments, for example, it brings changes to structures and processes, to communication, to the quality evaluation of research results, to data handling, to the role of locations, and to the way collaboration transcends the boundaries of subject disciplines, generations and time.

➤ **Digitization changes the need for qualification**

The continuous changes taking place within the research and technology landscape make it difficult to identify and implement training needs. In retrospect it is easy to recognize what has been overlooked. On the other hand the continual need to identify exactly which key qualifications may be required in the future is a huge challenge. Digital change necessitates the constant scrutiny of qualification requirements within study courses, especially in further education.

➤ **Digitization is changing the way we communicate and collaborate**

Digitization is making new demands on communication and collaboration both within the research community itself and between academia and other areas: (i) cross-border cooperation in research and teaching; (ii) interdisciplinary and intercultural work, both important elements of scholarly success; (iii) team-based cooperation across disciplines and professions.

➤ **Digitization requires constant critical reflection**

The wide range of possibilities offered by digitization and the new scientific approaches associated with it require more extensive in-depth reflection on questions of ethics, law and economy on the part of both individuals and institutions.

➤ **Digitization places new demands on governance**

Digital transformation places increasing demands on 'digital governance'. Information and communication play an important role as instruments in the overall design and management of this transformation process. These instruments place dynamic demands on the development of both a digital ecosystem and the measures required both to further the education, qualification and general awareness of those involved, and to ensure compliance with guidelines and regulations.

¹¹ Future Skills: Welche Kompetenzen in Deutschland fehlen. Stifterverband für die Deutsche Wissenschaft e.V., 2018. <https://www.future-skills.net/analysen/future-skills-welche-kompetenzen-in-deutschland-fehlen>.

¹² Rat für Informationsinfrastrukturen. 2019. <http://www.rfii.de/de/>.

¹³ Digitale Kompetenzen – dringend gesucht! Empfehlungen zu Berufs- und Ausbildungsperspektiven für den Arbeitsmarkt Wissenschaft. Rat für Informationsinfrastrukturen, 2019. <http://www.rfii.de/?p=3883>.

➤ **Digitization is changing research practice**

These changes do not only affect data, methods and results; they influence the whole process of research practice, from research involving bulk data, through generation and processing, scientific authorship using digital tools, down to the digital publication and re-use of research results and data.

➤ **Digitization is challenging the structure of the university and research landscape**

The diversity of the university and research landscapes can be seen both as a resource and a challenge. The overall aim must be to adapt current academic study and training programmes so that they already include the knowledge and skills required in the future. This necessitates the development of innovative forms of cooperation.

Essential skills

It is important to distinguish between generic *core digital literacy*, specialist or work-field related *special digital abilities*, and broader positions, attitudes, practices and intellectual and social skills. All these factors contribute to defining the *digital mindset* and lay the foundation for a successful course of action in the digital world.

Core digital skills:

- **Data literacy:** research, evaluation, collection / re-use, processing, analysis, formatting, management (administration, provision, sharing), backup, long-term archiving and publication, including familiarity with business models (licensing, funding)
- **Information literacy:** research, evaluation, management (administration, provision, sharing), security, long-term archiving and publication, including knowledge of business models (licensing, funding)
- **Digital communication:** communication using digital technologies, digital identity, information security
- **Digital collaboration:** in research infrastructures, with digital tools and technical infrastructures
- **Law and ethics:** copyright law, personal privacy law, data protection and information security, digital ethics (including the digital divide, digital sustainability, openness)

In view of the specific knowledge culture associated with each discipline and work context, special digital skills can only be identified and defined in relation to individual subjects and work-fields.

Digital mindset

- **Attitudes:** openness towards digital change, flexibility, adaptivity
- **Approaches:** ready and willing to accept change, positive attitude towards innovation
- **Participation:** respect for diversity and equal digital opportunities
- **Practice:** adoption of innovative technological and methodological methods and trends in learning processes
- **Reflection:** critical questioning of technical trends and problem-solving approaches to digital developments, of potential solutions and of technical added value; ability to assess the consequences of technological developments and to formulate further development needs.
- **Social skills:** social skills related to acting in digital contexts, in particular communicative and inter-cultural skills

Key elements for implementation

Digital change is leading to a transformation or permanent change in the way we live, communicate and work together. Both the scope of the associated social changes and the rapid pace at which they are occurring are leading to a vast increase in the need for qualifications in science, research, teaching and study. There are a variety of ways in which this transformation process permeates not only the paths providing access to the academic world but also the primary and secondary qualification processes. It thus begins with school education, continues during higher education and, in the form of lifelong learning, also affects further education and training. This leads to the immediate and challenging problem of how to train and deploy digitally qualified staff both quickly and in a targeted and quality-assured manner at the same time as the system itself is undergoing a process of continuous change.

The qualification process in this digital age can be expected to fulfil the expectations of both individual members and all the research institutions within the research and university sector. These members also include experienced experts from the fields of research, teaching and management.

- A distinction must be made between the digital transfer of skills and the transfer of digital skills. The former means using digital methods and processes in skills training, the latter means teaching actual digital skills.
- Digital skills transfer should become accepted as an established component of primary and secondary qualifications. In the sense of Constructive Alignment¹⁴, this will necessarily also encourage the acquisition of digital skills.
- The measures should be selected according to both the participants' previous level of education and the relevant professional and academic requirements profile.
- The theoretical, technical and context-related elements of the training programmes should go hand in hand with the practical development of digital skills, taking into account ethical and legal issues.
- Digitization will enable the rapid, transfer-oriented and flexible fulfilment of the qualification requirements. Analogue learning formats should be supplemented or, if necessary, replaced.

When planning and developing suitable educational measures, it should be borne in mind that digitization itself contributes to solving the challenges it creates. Digitization simplifies the quick and flexible networking of different data, information and systems. It enables the emergence of new insights, services and models of cooperation.

The changes triggered by this digitization process must be taken into account when developing qualification programmes. Accordingly, any high-quality further training programmes targeting active researchers from differing disciplines, who may have had many years of varying professional experience, will need to fulfil a set of complex and contradictory requirements.

- These will target both current members of the various research organizations and universities and future employees.
- They will aim to ensure that researchers and teachers have the skills required for digital, collaborative and interdisciplinary work (for example in individual departments or on projects).
- In addition to technological and digital skills, they will also focus on other areas of competence, for example on social or personal skills, combining these in innovative ways.
- They will respond to various learning habits so that groups of participants with widely differing previous education levels will find them relevant.

¹⁴ Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, 32(3), 347-364.

- They will offer formats and (digital) methods that can be used by part-time participants or which are suitable for self-study.
- They will be developed by communities, which will then exchange learning recommendations and share learning methods.
- They will be drawn up in agreement with all those involved in research organizations and universities in order to ensure broad general acceptance.
- They should carry positive career benefits for young scientists.

The role of the Alliance organizations

In summer 2008, the Alliance launched the “Digital Information” priority initiative as a joint project designed to improve information provision in research and teaching. The aim of the digital offensive is to identify topics collectively affecting all member organizations equally and to present appropriate solutions.

The lack of digitally qualified staff is a problem faced by all Alliance organizations; it poses a threat to the efficiency of the German research system and its compatibility with the international research environment. In view of the responsibility of the Alliance for the research system and the urgent need to find solutions to this problem, closer cooperation between the Alliance member organizations in this area is highly recommended. Collaborative solutions aimed at improving the situation should include short to long-term approaches, beginning with the transition from school to study, continuing to the study and qualification phases and concluding with high-level academic education. Possible solutions might, for example, involve exchanging details of measures or cooperative schemes already in operation within the Alliance organizations (examples of “good practice”) and the cooperative development of a variety of programmes, formats and strategies. Higher-level academic training in particular could benefit from cooperation with those specialist organizations at national and international level which have already acquired appropriate expertise in this area and have experience in networking methods. Another possibility might be the introduction of various kinds of cooperative counselling schemes or training programmes for knowledge multipliers.

In further papers it is planned to address proposals for possible cooperative solutions involving the Alliance organizations which have been put forward by the Working Groups 5 (Digital learning, teaching and networking) and 6 (Digitally qualified staff).