EU4Dual

EUROPEAN SCIENTIFIC JOURNAL FOR

VOL. 2 NUMBER 2 2026

DUAL HIGHER EDUCATION.

SPECIAL ISSUE

The socially relevant university – How can science, practice and society be successfully integrated?

Societal Relevance, Future Competences and Institutional Transformation

ISSN: 3052-7015

This journal is part of EU4DUAL

IMPRINT

European Scientific Journal for Dual Higher Education (ESJ DHE)

ISSN (online): *3052-7015*

Publisher: *EU4Dual European University Alliance*

Editor-in-Chief: *Prof. Dr. phil. habil. Ulf-Daniel Ehlers (Baden-Wuerttemberg Cooperative State University (DHBW), Germany)*

Managing Editors: *Dr. Norberta Sági (John von Neumann University, Hungary) | Florian Schäfer (Baden-Wuerttemberg Cooperative State University (DHBW), Germany) | Dr. Szilvia Varga (John von Neumann University, Hungary)*

Language and Copy Editing: *Florian Schäfer (Baden-Wuerttemberg Cooperative State University (DHBW), Germany) | Dr. Szilvia Varga (John von Neumann University, Hungary)*

Editorial Board Members: *Dr. Tomislav Bukša (PAR University of Applied Sciences, Croatia) | Dr. Ainara Imaz Aguirre (Mondragon University, Spain) | Dr. Minna Kaarakainen (Finnish Institute for Health and Welfare (THL), Finland) | Dr. Rajeev Kanth (Savonia University of Applied Sciences, Finland) | Dr. Elmar Krainz (FH Joanneum University of Applied Sciences, Austria) | Dr. Maria Luojus (Savonia University of Applied Sciences, Finland) | Dr. habil. Christophe Merlo (École supérieure des technologies industrielles avancées (ESTIA), France) | Dr. Gordana Nikolić (PAR University of Applied Sciences, Rijeka, Croatia) | Dr. Fernando António Trindade Rebola (Portoalegre Polytechnic University, Portugal) | Dr. Alison Said (Malta College of Arts, Science and Technology (MCAST), Malta) | Dr. habil. Anita Tangl (John von Neumann University, Hungary) | Dr. Marko Turk (National Scientific Institute for Migration Research / PAR University of Applied Sciences, Croatia) | Dr. Katja Wengler (Baden-Wuerttemberg Cooperative State University (DHBW), Germany) | Dr. habil. Teresa Żółkowska (Koszalin University of Technology, Poland)*

Contact: *Florian Schäfer (florian.schaefer@dhbw.de)*

Website: *https://ojs.eu4dualdevelopment.com/index.php/esjdhe*

Aims and Scope: The *European Scientific Journal for Dual Higher Education* is an open-access, peer-reviewed scholarly journal dedicated to research, theory, and practice in dual and work-integrated higher education. It serves as a European platform for interdisciplinary, evidence-based scholarship that connects academia and professional practice, promoting innovation, transformation, and future-skills development in higher education.

Editorial and Ethical Standards: The journal follows the ethical guidelines of the Committee on Publication Ethics (COPE). Authors, editors, and reviewers adhere to the highest standards of academic integrity, including policies on authorship, plagiarism, AI use disclosure, data transparency, and conflict of interest. Editorial independence is guaranteed; decisions are based solely on academic merit and relevance.

Copyright Notice: © 2026 European Scientific Journal for Dual Higher Education (ESJ DHE). Content may be shared and adapted under CC BY-NC 4.0 with proper attribution. Commercial use requires permission from the publisher.

Suggested Citation: Author(s) (2026). Article title. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), XX-XX. https://doi.org/10.82321/xxxxx

Disclaimer: The views and opinions expressed in the articles are those of the authors and do not necessarily reflect the positions of the Editor-in-Chief, Editorial Board, or the publisher.

CONTENTS

Editorial — Reconfiguring Higher Education: Societal Relevance, Future Competences, and Institutional Transformation
Ulf-Daniel Ehlers and Martin Lachmair i

Beyond the Third Mission: Pluralising Societal Relevance in Higher Education
David Kaldewey 1

Digital Skills Followed by Future Skills? Recent Research Insights and Impact on University Development
Jörn Allmang, Ulf-Daniel Ehlers, Laura Eigbrecht, Gerhard Götz, Myriam Hamich and Felix Weschenfelder 13

A Study of Stakeholder Perspectives on Established Characteristics and Areas for Development in a Cooperative State University in Germany
Ernst Deuer and Julian Fritsch 37

Promoting AI Literacy: Development, Implementation and Initial Validation of an AI Competency Model for Higher Education (AICM-HE)
Nils Aschhoff, Claudia Berg, Manuel Geisler, Miriam Hägerbäumer, Vera Lenz-Kesekamp and Miriam Stehling 53

Institutional Translation, Organisational Identity and AI in German Higher Education
Stephanie Ashford 67

Interprofessional Education in Health Sciences Programmes: Enabling Competence Development Through Constructive Alignment
Jan-Hendrik Ortloff, Manfred Fiedler and Daniela Schmitz 83

EDITORIAL — RECONFIGURING HIGHER EDUCATION: SOCIETAL RELEVANCE, FUTURE COMPETENCES, AND INSTITUTIONAL TRANSFORMATION*

European Scientific Journal for Dual Higher Education (ESJ DHE), Vol. 2, No. 2 (2026)

Prof. Dr. Ulf-Daniel Ehlers[1] and Prof. Dr. Martin Lachmair[2]

[1] Editor-in-Chief, European Scientific Journal for Dual Higher Education
EU4Dual European University Alliance
Baden-Wuerttemberg Cooperative State University (DHBW), NextEducation

[2] Conference Chair of the 2025 Annual Conference of the German Society for Higher Education Research (Gesellschaft für Hochschulforschung - GfHf) and
Baden-Wuerttemberg Cooperative State University (DHBW)

Dear readers,

Higher education is undergoing a period of profound transformation. Digitalisation, artificial intelligence, ecological pressures, changing labour-market expectations, and widening demands for societal relevance do not act in isolation; they reinforce one another and reshape the conditions under which universities understand and fulfil their mission. Questions of competence development, institutional adaptation, practice integration, and social responsibility have therefore moved from the margins to the centre of higher education research and development.

The 2025 annual conference of the German Society for Higher Education Research (Gesellschaft für Hochschulforschung – GfHf) in Heilbronn took up these questions and provided the intellectual ground for a broad collection of contributions. To give this breadth sufficient space, the special issue is published in two companion issues. This first issue concentrates on societal relevance, Future Skills, artificial intelligence, and institutional and curricular transformation. The second turns more explicitly to new learning spaces, practice-integrated formats, transfer, and educational inequality. The division is not a separation of unrelated themes, but an invitation to follow two closely connected lines of inquiry in greater depth.

The issue opens with *Beyond the Third Mission: Pluralising Societal Relevance in Higher Education*. The contribution establishes an important conceptual point of departure by challenging the idea that societal relevance is singular, self-evident, or endlessly expandable. Instead, it presents relevance as plural, contested, and relational. Higher education is thus not simply asked to become more useful; it must negotiate different public expectations while preserving its critical and educational functions.

Digital Skills Followed by Future Skills? Recent Research Insights and Impact on University Development extends this discussion from societal expectations to the capabilities needed to respond to them. By linking digital literacy, Future Skills, and university development, the article shows that competence cannot be treated as an isolated curricular add-on. What students and staff need to learn is inseparable from how institutions organise themselves, define educational quality, and prepare for uncertain futures.

A Study of Stakeholder Perspectives on Established Characteristics and Areas for Development in a Cooperative State University in Germany then grounds the debate empirically. Its findings show that established features of cooperative higher education continue to be valued while also revealing clear fields for development, including adaptation to artificial intelligence, stronger connections between theory and practice, more inclusive access, and greater attention to life skills.

* To cite this editorial: Ehlers, U.-D. and Lachmair, M. (2026). Editorial — Reconfiguring Higher Education: Societal Relevance, Future Competences, and Institutional Transformation. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), i-ii. https://doi.org/10.82321/07MA-34M61

The article therefore captures a central tension of institutional change: renewal must build on what works without turning institutional continuity into inertia.

The next two contributions place artificial intelligence at the centre of the discussion, but from complementary perspectives. *Promoting AI Literacy: Development, Implementation and Initial Validation of an AI Competency Model for Higher Education (AICM-HE)* presents a structured and practice-validated framework for embedding AI literacy in higher education. Its differentiated sectors and levels of competence respond to the heterogeneity of institutional contexts and offer a valuable basis for curricular development.

Institutional Translation, Organisational Identity, and AI in German Higher Education shifts the focus from individual competence to institutional self-representation. Through its examination of human translation, machine translation, and LLM-based workflows, the article demonstrates that AI is not merely a technical instrument. It also affects language politics, international visibility, and the ways in which universities articulate their identity. Read together, these two contributions make clear that responsible engagement with AI requires both competence architectures and institutional reflection.

The issue concludes with *Interprofessional Education in Health Sciences Programmes: Enabling Competence Development Through Constructive Alignment*. This article brings pedagogical design into sharp focus. It shows how the coherent alignment of learning outcomes, teaching methods, and assessment can support multidimensional competence development across professional boundaries. The contribution is particularly significant because it translates broad ambitions for relevance and competence into the concrete work of curriculum design.

Across these six contributions, three themes stand out. First, societal relevance is not an external demand that can simply be added to existing academic structures; it is negotiated through institutional missions, curricula, and relationships with society. Second, competence development must be understood broadly. It includes technical capability, but also critical judgement, ethical reflection, collaboration, autonomy, and the capacity to act under conditions of uncertainty. Third, transformation depends on institutional mediation: between continuity and change, technology and pedagogy, public expectations and academic responsibility.

This first companion issue therefore resists the idea of higher education transformation as a linear process of optimisation. The contributions instead reveal a field of negotiation in which competing purposes and pressures must be balanced. They offer conceptual frames, empirical evidence, competence models, and pedagogical designs that help us think more precisely about this work.

The second companion issue continues the conversation by asking where and through which arrangements transformation becomes tangible: in digital learning environments, agile professional learning, industry–university partnerships, third learning spaces, transfer-oriented research, and the unequal conditions of academic success. Together, the two issues trace a shared movement from purpose and competence to spaces, practices, and participation.

We hope that this issue stimulates discussion across disciplines, institutions, and national contexts. We thank all authors, reviewers, and editors whose work made this publication possible and whose contributions bring depth and differentiation to the debate about higher education’s present and future.

Prof. Dr. Ulf-Daniel Ehlers
Editor-in-Chief, European Scientific Journal for Dual Higher Education
EU4Dual European University Alliance
Baden-Wuerttemberg Cooperative State University (DHBW), NextEducation

Prof. Dr. Martin Lachmair
Conference Chair of the 2025 Annual Conference German Society for Higher Education Research (Gesellschaft für Hochschulforschung - GfHf)
Baden-Wuerttemberg Cooperative State University (DHBW)

European Scientific Journal for Dual Higher Education

Vol. 2, No. 2 (2026)
ISSN (online): 3052-7015

BEYOND THE THIRD MISSION: PLURALISING SOCIETAL RELEVANCE IN HIGHER EDUCATION

David Kaldewey [1*]

[1] *University of Bonn, Germany*

Keywords:
Relevance
Transfer
Third mission
Higher education management
Higher education policy

Article history:
Received: 15 January 2026
Revised: 29 April 2026
Accepted: 15 May 2026

To cite this article:
Kaldewey, D. (2026). Beyond the Third Mission: Pluralising Societal Relevance in Higher Education. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), 1-11. https://doi.org/10.82321/07MA-34M62

Abstract
Debates on societal relevance in higher education often assume that relevance is a singular and expandable good. Building on a discourse-analytical approach, this article challenges that assumption and conceptualises relevance as plural, contested, and relational. It shows how different relevance expectations generate structural tensions rather than cumulative gains and how relevance claims are negotiated across discourses of usefulness, risk, politicisation, and the third mission. By introducing a typology of modes of contestation, the article reframes societal relevance as a matter of balance rather than maximisation.

1 Introduction

What does it mean for higher education institutions to be "societally relevant"? Why is it, in the minds of various stakeholders, important to "build bridges" between academia and fields of practice such as industry, politics, or civil society? What exactly is implied when policy makers and evaluators urge researchers to demonstrate "impact"? Why do universities increasingly stress their contributions to solving the "grand challenges" of our time? Each of these questions invokes relevance in a different way. Yet the very frequency with which the notion is mobilised obscures its conceptual ambiguity. The matter gets even more confusing at the meta-level: For whom are higher education institutions presumed to be relevant, by what criteria, and according to which evaluative logics? All of these questions point towards the need for a more systematic understanding of the term.

The argument of this article – a revised version† of a keynote address for the annual conference of the Society for Higher Education Research (GfHf) in Heilbronn, Germany – grows out of a longer trajectory of engagement with relevance discourses in academia. Let me begin with a biographical anecdote that illustrates the ambivalence of practice-oriented research. Two decades ago, as a student assistant in a research project on socio-ecological transformation and organic agriculture, I

* Corresponding author
E-mail address: kaldewey@uni-bonn.de

† The present paper is based on the German keynote lecture manuscript. AI-based language tools were used to support the translation of the original text into English and to assist in the reformulation, condensation, and stylistic refinement of selected passages on the basis of the original manuscript. In this process, AI-generated drafts served as intermediate working versions that were subsequently reviewed, revised, and substantively reworked by the author.

spent an entire day calling organic farmers to recruit them as partners for transdisciplinary workshops. Not surprisingly, reaching them by phone was difficult. More surprising, however, were the responses I received from those who did answer, as several mentioned that they were already overburdened by obligations resulting from participation in such projects. The paradox is evident here: The urge to build bridges between theory and practice came primarily from university-based researchers, not from the practitioners. My early "aha moment" – the realisation that for the practitioners, "practice" is simply what they do, while for academics, "practice" is a desirable goal, a kind of promised land, something beyond their reach – has never left me. This observation resonated with earlier sociological analyses. Jürgen Friedrichs, writing in the late 1980s, described a "social scientific longing for practice" that served less the needs of practitioners than the normative and identity-building aspirations of sociological researchers themselves (Friedrichs, 1988, p. 10, my translation; cf. Kaldewey, 2016). The desire for relevance, in other words, is not necessarily an external demand placed upon academia. It can also be understood as internally produced, embedded in professional self-descriptions, and linked to broader cultural narratives about the role of science in society.

This early experience ultimately informed my academic trajectory. In my dissertation, I examined how "practice" was discursively constructed throughout the history of science and the history of universities – resulting in a semantic field whose evolution can be traced back over centuries, even millennia (Kaldewey, 2013, 2014). Since then, whenever policy makers or other stakeholders draw a distinction between "basic research" and "applied research" (Kaldewey & Schauz, 2018), demand to leave the „ivory tower" (Kaldewey, 2023), urge for "responsible research and innovation" (Flink & Kaldewey, 2018) or point to the "grand challenges" that have to be tackled by scientists (Kaldewey, 2018), I instinctively see semantic fields, historical trajectories, and the discursive labour through which academics continually affirm their external orientation. This *déformation professionnelle* of a sociologist of science forms the backdrop to the present essay.

Over the past decades, such narratives of relevance have multiplied and diversified, not least in the field of science studies and higher education research. By the end of the 20th century, the old distinctions – theory and practice, basic research and applied research – had become worn out. The 1990s in particular saw the emergence of new concepts aimed at reimagining scientific research and the role of universities in terms of their practical relevance. Scholars envisioned a "mode 2" of knowledge production (Gibbons et al., 1994; Nowotny et al., 2001) and a "postacademic science" that is commissioned for solving practical problems (Ziman, 2000). They diagnosed an "academic capitalism," in which universities were turned into entrepreneurial actors (Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004), conceptualised a "triple helix" that connects universities, industry, and governments (Etzkowitz & Leydesdorff, 1997, 2000), and proposed a "Pasteur's Quadrant" as a sphere in which basic science and technological innovation become reconciled (Stokes, 1997).* These frameworks, however, while influential, often seem to suggest that there exists a single, self-explanatory standard of relevance against which universities and research can be evaluated. They tend to depict higher education institutions as either successfully adapting to societal expectations or falling behind in an increasingly competitive and accountability-driven environment.

In the following, I propose a different approach. Rather than presuming a unitary meaning and definition of relevance, I argue that relevance is inherently *plural*. Universities are internally differentiated organisations in which research, teaching, and third mission activities follow distinct logics and interact with external environments in different ways. Moreover, society – aka "practice" – is not a monolithic entity but a constellation of multiple functional systems, professional fields, publics, and stakeholder groups – each with its own expectations of what counts as valuable or relevant knowledge. Relevance must therefore be understood as a relationship between specific internal aspects of the science system and specific external aspects of the social environment. This relational understanding of relevance also resonates with the concept of dual higher education, which is central to the focus of this journal: Rather than locating the "relevance" of education either within academic institutions or within vocational practice, dual higher education institutionalises their interrelation.

* While each of these frameworks inspired extensive research, none of them could establish itself as new master narrative. In the early 21st century, therefore, scholars and policy makers alike are in search of new semantics (Hessels & van Lente, 2008; Hessels et al., 2009; Maasen & Dickel, 2016; Rohe, 2017; Flink & Kaldewey, 2018).

2 Methodology

This article adopts a conceptual and analytical approach to the study of societal relevance in higher education. Rather than reporting original empirical data, it develops a theoretically informed synthesis of existing debates in science studies, higher education research, and organisational sociology. The analysis builds on long-term engagement with relevance discourses in academia and draws on historical and comparative perspectives to examine how relevance is constructed, evaluated, and contested (Kaldewey, 2013, 2014, 2016; Kaldewey & Schauz, 2017, 2018; Flink & Kaldewey, 2018; Kaldewey, 2018; Hamann et al., 2019).

Methodologically, the article combines elements of conceptual history with discourse-analytical tools (Schauz, 2014; Schauz & Kaldewey, 2023). It reconstructs recurring patterns across influential discourses through which relevance is articulated, justified, and problematised. The selection and synthesis of the debates discussed in this article follow a qualitative and theory-guided logic rather than a systematic review procedure. The analysis focuses on discourses that have been particularly influential in shaping how societal relevance is articulated in higher education and science policy, including long-standing debates on usefulness, risk, and the political role of science, as well as more recent institutionalised frameworks such as the third mission. More specifically, these discourses were selected because of their pervasiveness across higher education systems and across time, whereas more marginal or context-specific debates were not considered. The four modes of contestation introduced later in the article should be understood as heuristic analytical constructs. They are not derived from a systematic empirical classification, nor do they constitute ideal types in a strict Weberian sense.

The subsequent sections develop this perspective in three steps. Section 3 introduces a conceptual framework that accounts for the plurality of relevance by differentiating between internal, external, and meta-level perspectives. Building on this framework, Section 4 identifies recurring modes through which relevance becomes contested. Finally, Section 5 reflects on the organisational implications of these dynamics and introduces the notion of a relevance balance.

3 The pluralisation of relevance

Debates about the societal role of higher education typically employ a singularised vocabulary: the usefulness of universities, *the* relevance of research, *the* impact of science. Policy documents and public debates often assume that relevance is a stable, universal criterion, measurable through generalisable indicators or assessment tools. Yet such singularisation obscures the heterogeneity of expectations directed at universities and masks the internal differentiation of academic institutions themselves.

It is noticeable that key concepts in both higher education policy frameworks and academic discourses mirror this tendency towards singularisation: Terms such as “third mission”, “technology transfer”, “transdisciplinarity”, “science communication”, “citizen science”, or “impact” are often depicted as coherent and unified categories. Similarly, the influential diagnoses from the 1990s use singularised concepts as well: “mode 2”, “triple helix”, “academic capitalism”, “postacademic science”, “responsible research and innovation” all suggest that a single model captures the changing relationship between science and society. There are interesting exceptions, however. The traditional basic/applied distinction, for instance, made it possible to speak of “applied sciences” in the plural in the 19th and 20th centuries – although the singular form “applied science” has remained more common (cf. Bud, 2024). More recently, the category of “grand challenges” explicitly points to a plurality of problems that need to be addressed (Kaldewey, 2018). Likewise, notions such as “future skills” emphasise the multiplicity of competencies required in higher education (Ehlers, 2020). These examples illustrate that it would be unsatisfying to assume that there is only one “grand challenge” or only one “future skill” that has to be trained in higher education institutions.

Against this backdrop, this section argues that relevance must be approached in the plural. It introduces a threefold analytical distinction – internal perspectives, external perspectives, and meta-level evaluative perspectives – and shows how each highlights different dimensions of how universities engage with society. This differentiation makes visible that relevance is not a property

CC BY NC

but a relation. It emerges when specific dimensions of academic work intersect with specific environments, audiences, and evaluative contexts.

3.1 Internal perspectives: Differentiation within universities

Universities are not monolithic organisations; they comprise a plurality of missions, functions, and organisational substructures. As such, different parts of the university relate to society in distinct ways. Internal relevance discourses are therefore heterogeneous, reflecting the differentiated nature of academic labour.

(a) The domain most frequently associated with societal relevance is research (see, for example, Hessels et al., 2009). Policy discourses invoke expectations of innovation, technology transfer, and problem-solving capacity, particularly in STEM fields. Yet even within the sphere of research, relevance is far from homogeneous (Hamann et al., 2019). Different types of research and different disciplines operate within different temporalities, audiences, and epistemic cultures. Basic research, on the one hand, emphasises curiosity-driven inquiry and epistemic autonomy, defending its societal value through indirect or long-term arguments. Applied research, on the other hand, demonstrates more immediate utility but often embeds itself in specific stakeholder relationships or economic frameworks. These differences complicate generalised statements about "the relevance of research." What counts as valuable knowledge in one discipline may be irrelevant in another; what one societal environment demands (e.g., rapid innovation cycles in the private sector) may contradict what another values (e.g., normative legitimacy in policymaking or interpretive depth in the humanities).

(b) What about the second mission of the university? Paradoxically, teaching is both the most immediate interface between universities and their social environments and the one whose importance is least recognised in relevance debates. In the era of mass and universal higher education (Trow, 2010), universities educate large portions of national populations, prepare professionals for all major societal fields, and cultivate the competencies necessary for democratic citizenship. Yet public and policy discourses rarely frame teaching as a primary vector of relevance. This neglect is partly due to the structure of policy incentives, which often prioritise research outputs. Teaching is frequently perceived as an internal affair of the university rather than as their contribution to the world outside. Consequently, the societal relevance of teaching – its long-term influence on social systems, professions, and public culture – is systematically undervalued. This imbalance has significant implications for how universities allocate resources and how academics distribute their efforts across missions.

(c) Since the late 1990s, the "third mission" of academic activity has gained prominence (Laredo, 2007; Pinheiro et al., 2015). Initially focused on technology transfer and economic innovation, the third mission concept has expanded to include policy advice and expert consultation, continuing education and lifelong learning programmes, public engagement and science communication, social and cultural outreach, and, more recently, sustainability initiatives and diversity strategies. The career of third mission discourses exemplifies the institutionalisation of relevance expectations. Its expansion signals the perceived need to supplement traditional missions of research and teaching with more specific and visible forms of engagement. Yet this institutionalisation also produces complex internal effects: it redistributes organisational attention, generates new administrative units, and creates symbolic performances of relevance that may or may not correlate with substantive societal outcomes.

In view of the three missions, it becomes evident that internal relevance discourses are shaped by intrinsic trade-offs. Each mission – research, teaching, and the varieties of outreach – demands time, resources, and institutional support. Because universities operate under conditions of organisational scarcity, increased activity in one area typically requires reductions elsewhere. The proliferation of third mission activities often follows a "more is better" rationale: more engagement, more transfer, more communication. Yet each initiative introduces opportunity costs. Administrative staff devote time to designing, coordinating, and reporting on outreach activities; academic staff allocate time to public engagement or cross-sector collaborations; leadership teams dedicate attention to strategic positioning. These shifts may produce beneficial external visibility but reduce the university's internal capacity to support teaching and research. Against this background, the

question arises how to conceptualise relevance not as an additive good but as part of a *relevance balance*, i. e. an equilibrium that can be improved or diminished depending on how the university distributes its resources across missions.

3.2 External perspectives: Multiple societal environments

Just as internal differentiation of universities produces multiple internal relevance discourses and practices, the external environment is itself plural. Society does not constitute a single unitary addressee. Instead, universities are embedded in a landscape of differentiated functional systems, local publics and stakeholders, as well as national and global actors- each with its own rationality and expectations.

(a) First, building on sociological systems theory, we may conceptualise the political system, the economic system, the legal system, the health system, etc. as distinct societal environments (Luhmann, 1997). Universities interact with each of these systems in specific ways (Weingart, 2001). The economy values skilled labour, innovation, and technology transfer, while politics seeks expertise, legitimacy, and solutions to collective problems. In addition, the legal system demands jurisprudential knowledge and highly trained professionals. The health system relies heavily on medical education, translational research, clinical studies, and clinical training. Each system evaluates relevance differently. A single form of academic output may therefore be highly relevant to one system but irrelevant – or even disruptive – to another.

(b) Beyond such societal macro systems, universities also interact with a wide array of local publics, professional associations, interest groups, and civil society organisations. They shape expectations, disseminate findings, react to controversies, and influence policy. Publics are inherently heterogeneous. They range from local communities affected by campus development to global audiences following scientific debates on climate change, artificial intelligence, or biomedical innovations. Stakeholder groups may include industry partners, NGOs, cultural institutions, or activist networks. Each public constitutes a distinct evaluative environment that interprets academic outputs according to its own concerns, values, and priorities. Therefore, if these publics are organised, they can act as intermediaries between the academic world and various social contexts (cf. Caves & Oswald-Egg, 2024).

(c) Furthermore, external relevance expectations are strongly shaped by national higher education systems, cultural norms, geopolitical dynamics and various actors operating at these levels. Universities are thus embedded in “sociotechnical imaginaries” that have often co-evolved with nation states (Jasanoff & Kim, 2015; Kaldewey et al., 2020). Countries vary widely in what they expect from their universities – some prioritise economic competitiveness; others emphasise civic education or national identity; still others focus on innovation ecosystems or state-building. Global power configurations influence which forms of research are prioritised or contested, particularly in areas such as biotechnology, military technology, or climate science. Understanding relevance therefore requires contextualisation: what counts as societal contribution in one national setting may be interpreted differently in another.

Across these external environments, relevance emerges as a structural coupling – a concept borrowed from systems theory to describe stable but selective connections between social systems (Luhmann, 1997; Stichweh, 2014). For example, dual higher education programmes couple universities with labour markets by institutionalising interactions between academic learning and professional practice. Thus, dual higher education can be understood as an organisational form in which relevance is continuously co-produced across different contexts within and beyond the university. Such structural couplings shape which academic activities are likely to resonate externally and which remain confined to the academic sphere. At the same time, they may create tensions when expectations from different systems conflict – for instance, when political demands for rapid solutions clash with academic temporalities or methodological standards.

CC BY NC

3.3 Meta-level perspective: Plural modes of valuation

At a meta-level, societal relevance increasingly appears not only as something universities are expected to produce, but as something that must be measured, evaluated, and made governable.* Contemporary higher education systems are permeated by evaluation regimes that assess not only the quality of academic knowledge, but also its usefulness. In this context, relevance no longer functions merely as a semantic claim about the relationship between science and society, but as an object of formalised evaluation. What counts as relevant is increasingly shaped by the instruments designed to measure and compare relevance.

These evaluative infrastructures often suggest that relevance could, in principle, be captured through unified or at least harmonised frameworks. Formal assessment exercises as well as narrative modes of demonstrating relevance tend to operate with implicit assumptions of commensurability, even when they acknowledge disciplinary or contextual variation. Yet such assumptions obscure a more fundamental characteristic of relevance: its evaluation is itself irreducibly plural. There is no single procedure through which the societal value of academic work can be assessed without remainder. Rather, different "modes of evaluation" mobilise different normative expectations, temporal horizons, and sources of legitimacy (Hamann et al., 2019): Historical and narrative accounts of useful scientific contributions, standardised assessment procedures, and participatory or stakeholder-oriented evaluations do not merely apply different tools to the same object; they enact different conceptions of relevance. Each mode foregrounds certain dimensions of academic work while backgrounding others, producing distinct forms of visibility and invisibility that are not mutually reducible.

This plurality of modes of evaluation should not be misunderstood as a transitional problem to be solved through better indicators or more comprehensive frameworks. On the contrary, it reflects the structural heterogeneity of scientific knowledge and its multiple societal entanglements. Attempts to impose singular or hierarchical regimes of relevance evaluation risk narrowing the spectrum of legitimate academic contributions and privileging those forms of knowledge production that align most easily with dominant assessment logics. In doing so, they may undermine precisely those forms of epistemic diversity and long-term orientation that sustain the problem-solving capacity of science. Therefore, evaluative pluralism is not an obstacle to scientific autonomy but one of its preconditions. The capacity of universities to relate to different societal environments in self-determined ways depends on the availability of multiple, partially incompatible modes of evaluation.

Seen together, the internal, external, and meta-level perspectives suggest that relevance emerges as a dynamic equilibrium shaped by organisational choices, societal expectations, and evaluative pressures. An institution may increase its relevance in one domain while diminishing it in others. For instance, extensive outreach may improve public visibility but reduce the time individual academics spend on research. Vice versa, increased research productivity may enhance disciplinary prestige but weaken local engagement. These trade-offs illustrate that relevance is neither additive nor unlimited. A university's overall societal contribution depends on how it balances competing demands and allocates resources across missions.

4 Contested relevances

If societal relevance takes shape through such precarious equilibria, it is hardly surprising that it becomes contested. Balancing heterogeneous expectations does not eliminate tensions but renders them visible. Contestation does not simply stem from misunderstandings or disagreements about evidence. Rather, it reflects deeper structural frictions in how academic practices intersect with societal interests and values. Different actors attribute relevance according to different criteria, operate in different temporal horizons, and draw on different sources of legitimacy. As a result, what appears as a meaningful societal contribution from one perspective may be perceived as insufficient, problematic, or even harmful from another. Building on the conceptual framework developed in the

* The following considerations build on an argument that Julian Hamann, Julia Schubert and the author developed to answer the Prize Question of the Austrian Academy of Sciences (ÖAW) in 2018: "Can the social relevance of relevance be evaluated and, if so, how?" Our essay was awarded the first prize, for the published original version see Hamann et al. (2019), for an updated version see Hamann & Schubert (2023).

previous section, the following analysis introduces a heuristic typology of modes of contestation. These modes are not intended as exhaustive categories, but as analytical lenses that reveal how relevance is negotiated and disputed.

4.1 The usefulness discourse: When relevance is imperative

One of the most familiar forms in which societal relevance becomes contested concerns the question of usefulness. Academic knowledge is repeatedly expected to demonstrate tangible benefits, practical solutions, or immediate applicability. Within this horizon, relevance is often implicitly equated with utility: research is considered relevant insofar as it can be used, applied or transferred.

Historically, this equation has always been fragile. Long before contemporary impact discourses, modern science developed a self-description that explicitly distanced itself from immediate usefulness. The ideal of ”pure science“ – and later the notion of „basic research“ – articulated a claim to relevance grounded not in direct application, but in the production of reliable knowledge and theoretical insight. Its societal significance was assumed to unfold indirectly, unpredictably, and often only over extended periods of time.

From this perspective, the usefulness discourse appears less as a dispute about where to draw the line between relevant and irrelevant knowledge than as a conflict between different expectations and temporal horizons of relevance. For example, few scientific achievements have had consequences as far-reaching as the atomic bomb, yet it resists any unambiguous characterisation as “useful”. Conversely, activities such as the interpretation of poetry or the study of ancient languages are frequently dismissed as useless, despite their role in sustaining cultural orientation and critical reflection.

Disputes over usefulness therefore do not concern the presence or absence of societal effects. They revolve around which effects count as relevant and why, who defines usefulness, and on what time scales such judgements are made (Hamann et al., 2019; Hamann & Schubert, 2023). Research that promises immediate applicability is often privileged by policy makers and other stakeholders, while forms of knowledge whose relevance unfolds slowly or indirectly tend to be marginalised. In this sense, the usefulness discourse does not resolve the problem of relevance; it exemplifies why relevance itself remains contested.

4.2 The risk discourse: When relevance becomes problematic

A second mode in which societal relevance becomes contested emerges where research is perceived not as insufficiently relevant, but as excessively so – and not in the intended ways. In these cases, scientific knowledge is not criticised for lacking impact, but for producing consequences that are considered dangerous, uncontrollable, or socially unacceptable. Relevance here takes the form of risk.

Again, few examples illustrate this more clearly than the development of the atomic bomb. Scientific research in this field proved to be profoundly relevant in societal terms, yet precisely this relevance turned into a source of moral, political, and existential conflict.* Similar dynamics can be observed in contemporary debates surrounding biotechnology, artificial intelligence, or medical research. In these contexts, scientific knowledge is no longer primarily assessed in terms of its usefulness, but in terms of its potential for harm.

The risk discourse thus reverses the logic of the usefulness discourse. While the latter demands more relevance, applicability, and societal impact, the former questions whether certain forms of research should be pursued at all. Research becomes contested not because it fails to address societal problems, but because it intervenes too deeply, too rapidly, or too irreversibly into social and natural processes. These dynamics echo classic diagnoses of modern risk societies (Beck, 1992). Importantly, such contestations are not external to science. They often arise from within scientific communities themselves, where researchers reflect on the unintended

* This is reflected, for example, by the group of physicists who participated in the Manhattan Project and who, following the first use of the atomic bomb in 1945, founded the Atomic Scientists’ Association, which continues until today publishes the ”Bulletin of the Atomic Scientists” (Mecklin, 2025).

CC BY NC

consequences of their work and call for restraint, regulation, or ethical oversight (Forge, 2008). The risk discourse therefore highlights a second structural tension of relevance: scientific knowledge may be societally relevant in ways that undermine its legitimacy. Relevance, in this sense, does not simply generate acceptance; it can also provoke resistance and demands for limitation.

4.3 The ideology discourse: When relevance becomes politicised

A third mode in which societal relevance becomes contested emerges where academic knowledge is drawn into broader political and cultural conflicts. In these cases, research is not primarily criticised for lacking usefulness or for producing unacceptable risks, but for its perceived normative orientation. Relevance here becomes a matter of ideology and political alignment.

This dynamic is particularly visible in the contemporary Culture Wars in the United States, where universities have become central arenas of cultural polarisation (Binder, 2025). Research on topics such as climate change, public health, or diversity is frequently attacked not as irrelevant or erroneous, but as ideologically driven. Academic institutions are accused of promoting "woke agendas," indoctrinating students, or undermining traditional values. Conversely, the same research is often defended precisely because it takes a clear stance on contested societal issues. These conflicts are not about whether academic knowledge matters. On the contrary, the societal impact is presupposed – and precisely is marked as the problem. The dispute thus concerns *what kind* of academic knowledge should matter, and *what kind* of knowledge should be dismissed as ideological.

At first sight, this politicisation appears to be imposed on universities from the outside. A closer look at the academic world, however, reveals internal disagreements about the appropriate relationship between expertise, activism, and public responsibility. Calls for value neutrality coexist with expectations that universities should actively contribute to social justice, democratic resilience, or cultural change. In this context, relevance becomes a contested attribute, shaped less by epistemic criteria than by conflicting values and political identities.

4.4 The third mission discourse: Relevance rituals and organisational balancing

A fourth mode in which societal relevance becomes contested in higher education is articulated through the third mission discourse. In this context, relevance is no longer primarily negotiated in terms of usefulness, risk, or political alignment, but through organised efforts to demonstrate engagement, responsibility, and contributions beyond research and teaching. Relevance becomes institutionalised. Following the neo-institutionalist perspective (Meyer & Rowan, 1977), one might speak of *relevance rituals* to describe organisational practices that publicly signal societal responsiveness without necessarily transforming core academic activities. Sustainability offices, diversity strategies, outreach programmes and science communication events exemplify such rituals. They render relevance visible, communicable, and auditable, thereby stabilising legitimacy vis-à-vis external audiences. At the same time, their effects often remain indirect, symbolic, and difficult to assess.

Relevance rituals are not merely superficial or cynical gestures. They fulfil important organisational functions by translating diffuse societal expectations into manageable formats. Yet precisely because they operate at the level of representation and coordination, they risk decoupling demonstrated relevance from substantive societal impact. What counts as relevant increasingly aligns with what can be organised, documented, and communicated within existing institutional structures. The third mission discourse thus foregrounds organisational trade-offs in a particularly explicit way. Resources devoted to relevance rituals – coordination units, reporting procedures, strategic initiatives – are resources not available for research or teaching. While such practices may enhance visibility and legitimacy, they can also generate additional burdens and shift attention towards ritualised forms of relevance. In this sense, the third mission discourse makes explicit a central insight of this article: societal relevance is not an unlimited good. It is produced, distributed, and constrained through organisational decisions that inevitably involve prioritisation of some goals and exclusion of others.

5 Conclusion: Relevance as balance

Debates about the societal relevance of higher education and academic research are often driven by an implicit assumption that more engagement, more visibility, and more impact are always desirable. This assumption obscures a fundamental characteristic of universities as organisations: they operate under conditions of scarcity, internal differentiation, and competing expectations across research, teaching, and third mission activities. Societal relevance, as this article has argued, is therefore not something that can simply be maximised. It must be balanced.

Recognising this practical constraint leads to a conceptual shift: abstract postulates of relevance in the singular give way to empirically grounded notions of *multiple* and *contested relevances*. Relevance, as the analysis has shown, is plural at several levels. It is shaped by heterogeneous structures internal to the university, by diverse and often conflicting external expectations, and by plural modes of evaluation. Furthermore, relevance claims are contestable in several dimensions. The usefulness discourse highlights tensions between immediate applicability and long-term knowledge production. The risk discourse demonstrates that relevance may take forms that undermine legitimacy rather than enhance it. The ideology discourse reveals how relevance can become politically charged, contested not for its absence but for its normative implications. Finally, the third mission discourse illustrates how relevance is increasingly institutionalised through organisational practices and rituals that stabilise legitimacy while simultaneously generating new trade-offs. Taken together, these modes of contestation make clear that societal relevance is not additive. Increasing relevance in one dimension may reduce it in another. Extensive engagement activities may strengthen public visibility while constraining the time and attention available for research and teaching. Conversely, intensified research productivity may enhance the disciplinary prestige of individual academics or departments while weakening their local or societal connectedness. Such dynamics are not pathologies or failures of governance. They reflect the structural conditions under which universities operate.

Understanding relevance as a *matter of balance* shifts the perspective from optimisation to judgement. The question is no longer how relevance can be measured more comprehensively or demonstrated more convincingly, but how institutions navigate competing relevance claims under conditions of limited resources and organisational complexity. From a governance perspective, this implies that universities should not simply expand engagement activities, but rather prioritise and coordinate competing relevance claims across their core missions. This affects the allocation of resources between research, teaching, and third mission activities, the design of incentive structures for academic staff, and the evaluation of institutional performance. This becomes particularly visible in the case of dual higher education, where balancing academic and practical orientations is structurally embedded in curricula and cooperation agreements. Policies that promote societal relevance without accounting for these trade-offs risk overburdening organisations and generating symbolic rather than substantive forms of engagement. At the same time, regimes of evaluation that seek to standardise or hierarchise relevance tend to privilege those forms of engagement that are most visible, most easily communicable, or most compatible with prevailing assessment logics, thereby marginalising alternative forms of societal impact.

To summarise, a balanced understanding of relevance requires tolerance for plurality, acceptance of trade-offs, and institutional spaces for reflexive judgement rather than permanent expansion. Seen in this light, societal relevance is neither an external demand to be satisfied nor an internal virtue to be maximised. It is a relational and contested achievement that depends on how universities align their multiple missions over time.

References

Beck, U. (1992). *Risk Society: Towards a New Modernity*. Sage.

Binder, A. J. (2025). Cultural Conflict in Higher Education. In *Contemporary Social Movements* (pp. 171-176). https://doi.org/10.1002/9781394300365.ch24

Bud, R. (2024). *Applied Science: Knowledge, Modernity, and Britain's Public Realm*. Cambridge University Press.

Caves, K., & Oswald-Egg, M. E. (2024). The networked role of intermediaries in education governance and public-private partnership. *Journal of Education Policy, 39*(1), 40-63. https://doi.org/10.1080/02680939.2023.2190166

Ehlers, U.-D. (2020). *Future Skills. Lernen der Zukunft – Hochschule der Zukunft*. Springer VS.

Etzkowitz, H., & Leydesdorff, L. (Eds.). (1997). *Universities and the Global Knowledge Economy. A Triple Helix of University-Industry-Government Relations*. Pinter.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy, 29*(2), 109-123. https://doi.org/10.1016/S0048-7333(99)00055-4

Flink, T., & Kaldewey, D. (2018). The new production of legitimacy: STI policy discourses beyond the contract metaphor. *Research Policy, 47*(1), 14-22. https://doi.org/10.1016/j.respol.2017.09.008

Forge, J. (2008). *The Responsible Scientist. A Philosophical Inquiry*. University of Pittsburgh Press.

Friedrichs, J. (1988). Stadtsoziologie – Wohin? [Urban Sociology – Where to?] In J. Friedrichs (Ed.), *Soziologische Stadtforschung* (pp. 7-17). Westdeutscher Verlag.

Gibbons, M., et al. (1994). *The New Production of Knowledge. The Dynamics of Science and Research in Contemporary Societies*. Sage.

Hamann, J., Kaldewey, D., & Schubert, J. (2019). Ist gesellschaftliche Relevanz von Forschung bewertbar und wenn ja, wie? [Can the societal relevance of research be assessed, and if so, how?] In Österreichische Akademie der Wissenschaften & J. Schmitt (Eds.), *Forschung und Gesellschaft 14* (pp. 13-27).

Hamann, J., & Schubert, J. (2023). Nützliche Forschung: Die Bewertung und Vermessung der gesellschaftlichen Relevanz von Wissenschaft [Useful research: assessing and measuring the social relevance of science]. In D. Kaldewey (Ed.), *Wissenschaftsforschung* (pp. 221-236). De Gruyter Oldenbourg. https://doi.org/10.1515/9783110713800-011

Hessels, L. K., & van Lente, H. (2008). Re-thinking new knowledge production: A literature review and a research agenda. *Research Policy, 37*(4), 740-760. https://doi.org/10.1016/j.respol.2008.01.008

Hessels, L. K., van Lente, H., & Smits, R. (2009). In search of relevance: The changing contract between science and society. *Science and Public Policy, 36*(5), 387-401. https://doi.org/10.3152/030234209X442034

Jasanoff, S., & Kim, S.-H. (Eds.). (2015). *Dreamscapes of Modernity. Sociotechnical Imaginaries and the Fabrication of Power*. University of Chicago Press.

Kaldewey, D. (2013). *Wahrheit und Nützlichkeit. Selbstbeschreibungen der Wissenschaft zwischen Autonomie und gesellschaftlicher Relevanz* [Truth and utility: science's self-descriptions between autonomy and societal relevance]. Transcript.

Kaldewey, D. (2014). Die Autonomie der Wissenschaft als semantischer Raum. Differenzierungsprozesse zwischen Antike und Renaissance [The autonomy of science as a semantic space: processes of differentiation between Antiquity and the Renaissance]. In M. Franzen, A. Jung, D. Kaldewey, & J. Korte (Eds.), *Autonomie revisited. Beiträge zu einem umstrittenen Grundbegriff in Wissenschaft, Kunst und Politik* (pp. 115-142). Beltz Juventa. https://doi.org/10.17879/zts-2014-529

Kaldewey, D. (2016). Die Sehnsucht nach der Praxis. Beobachtungen zur Identitätsarbeit der Sozialwissenschaften [The longing for practice: observations on identity work in the social sciences]. In D. Simon, A. Froese, & J. Böttcher (Eds.), *Sozialwissenschaften und Gesellschaft. Neue Verortungen von Wissenstransfer* (pp. 129-157). Transcript. https://doi.org/10.1515/9783839434024-005

Kaldewey, D. (2018). The Grand Challenges Discourse: Transforming Identity Work in Science and Science Policy. *Minerva, 56*(2), 161-182. https://doi.org/10.1007/s11024-017-9332-2

Kaldewey, D. (2023). Wissenschaft und Gesellschaft [Science and society]. In D. Kaldewey (Ed.), Wissenschaftsforschung (pp. 31-54). De Gruyter Oldenbourg. https://doi.org/10.1515/9783110713800-002

Kaldewey, D., Russ, D., & Schubert, J. (2020). The Politics of Technoscience: From National Visions to Global Problems. In S. Maasen, S. Dickel, & C. Schneider (Eds.), *TechnoScienceSociety* (pp. 191-208). Springer. https://doi.org/10.1007/978-3-030-43965-1_11

Kaldewey, D., & Schauz, D. (2017). "The Politics of Pure Science" Revisited. *Science and Public Policy, 44*(6), 883-886. https://doi.org/10.1093/scipol/scx060

Kaldewey, D., & Schauz, D. (Eds.). (2018). *Basic and Applied Research: The Language of Science Policy in the Twentieth Century*. Berghahn books.

Laredo, P. (2007). Revisiting the Third Mission of Universities: Toward a Renewed Categorization of University Activities? *Higher Education Policy, 20*, 441-456. https://doi.org/10.1057/palgrave.hep.8300169

Luhmann, N. (1997). *Die Gesellschaft der Gesellschaft* [Theory of society]. Suhrkamp.

Maasen, S., & Dickel, S. (2016). Partizipation, Responsivität, Nachhaltigkeit. Zur Realfiktion eines neuen Gesellschaftsvertrags. In D. Simon & others (Eds.), *Handbuch Wissenschaftspolitik* (pp. 225-242). Springer VS. https://doi.org/10.1007/978-3-658-05455-7_21

Mecklin, J. (2025). The recent past and foreseeable future of the Bulletin of the Atomic Scientists: A conversation. *Bulletin of the Atomic Scientists, 81*(6), 409-417. https://doi.org/10.1080/00963402.2025.2586957

Meyer, J. W., & Rowan, B. (1977). Institutionalized Organizations. Formal Structures as Myth and Ceremony. *American Journal of Sociology, 83*(2), 340-363. https://www.jstor.org/stable/2778293

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-Thinking Science. Knowledge and the Public in an Age of Uncertainty*. Polity Press.

Pinheiro, R., Langa, P. V., & Pausits, A. (2015). One and two equals three? The third mission of higher education institutions. *European Journal of Higher Education, 5*(3), 233-249. https://doi.org/10.1080/21568235.2015.1044552

Rohe, W. (2017). The Contract between Society and Science: Changes and Challenges. *Social Research, 84*(3), 739-757. https://www.jstor.org/stable/26550359

Schauz, D. (2014). Wissenschaftspolitische Sprache als Gegenstand von Forschung und disziplinärer Selbstreflexion. Das Programm des Forschungsnetzwerks CASTI [The language of science policy as a subject of research and disciplinary self-reflection: the CASTI research network programme]. *Forum Interdisziplinäre Begriffsgeschichte, 3*(2), 49-61.

Schauz, D., & Kaldewey, D. (2023). Diskursanalyse und Historische Semantik in der Wissenschaftsforschung [Discourse Analysis and Historical Semantics in Science Studies]. In D. Kaldewey (Ed.), *Wissenschaftsforschung* (pp. 315-336). De Gruyter Oldenbourg. https://doi.org/10.1515/9783110713800-015

Slaughter, S., & Leslie, L. L. (1997). *Academic Capitalism. Politics, Policies, and the Entrepreneurial University*. Johns Hopkins University Press.

Slaughter, S., & Rhoades, G. (2004). *Academic Capitalism and the New Economy. Markets, State, and Higher Education*. Johns Hopkins University Press.

Stichweh, R. (2014). Differenzierung und Entdifferenzierung: Zur Gesellschaft des frühen 21. Jahrhunderts [Differentiation and de-differentiation: on society in the Early 21st century]. *Zeitschrift für Theoretische Soziologie, 3*(1), 8-19. https://doi.org/10.17879/zts-2014-4027

Stokes, D. E. (1997). *Pasteur's Quadrant. Basic Science and Technological Innovation*. Brookings Institution Press.

Trow, M. (2010). *Twentieth-Century Higher Education. Elite to Mass to Universal*. Johns Hopkins University Press.

Weingart, P. (2001). *Die Stunde der Wahrheit? Zum Verhältnis der Wissenschaft zu Politik, Wirtschaft und Medien in der Wissensgesellschaft* [The moment of truth? On the relationship between science, politics, the economy and the media in the knowledge society]. Velbrück Wissenschaft.

Ziman, J. (2000). *Real Science. What it is, and what it means*. Cambridge University Press.

European Scientific Journal for Dual Higher Education

Vol. 2, No. 2 (2026)
ISSN (online): 3052-7015

DIGITAL SKILLS FOLLOWED BY FUTURE SKILLS? RECENT RESEARCH INSIGHTS AND IMPACT ON UNIVERSITY DEVELOPMENT

Jörn Allmang [1], Ulf-Daniel Ehlers [1], Laura Eigbrecht [1], Gerhard Götz [1], Myriam Hamich [1] and Felix Weschenfelder [2]*

[1] Baden-Wuerttemberg Cooperative State University (DHBW) and Institute for Higher Education and Educational Research (IHB) of the Baden-Wuerttemberg Cooperative State University (DHBW), Germany

[2] Baden-Wuerttemberg Cooperative State University (DHBW), Institute for Higher Education and Educational Research (IHB) of the Baden-Wuerttemberg Cooperative State University (DHBW) and Heidelberg University of Education, Germany

Keywords:
Future skills
Digital literacy
Computer science competences
Higher education development

Article history:
Received: 22 January 2026
Revised: 10 June 2026
Accepted: 2 July 2026

To cite this article:
Allmang, J., Ehlers, U.-D., Eigbrecht, L., Götz, G., Hamich, M. & Weschenfelder, F. (2026). Digital Skills Followed by Future Skills? Recent Research Insights and Impact on University Development. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), 13-36. https://doi.org/10.82321/07MA-34M63

Abstract
This paper addresses the challenges of societal, technological, and ecological transformations from an integrative, practice-informed perspective that explicitly connects Future Skills, digital literacy, and computer science competences with institutional development in higher education and programme design. The contribution synthesises insights from interdisciplinary case studies that were condensed, presented, and critically discussed in a scholarly symposium format. Each intervention was implemented within design-based research setting. The findings suggest that implementations are more successful when they allow flexibility and supervision and embed students' reflection.

1 Introduction

Over the past decade, higher education institutions have been confronted with profound societal, technological, and ecological transformations that challenge established assumptions about academic learning and graduate preparedness. Digitalisation, artificial intelligence, sustainability transitions, and accelerating innovation cycles increasingly confront graduates with uncertainty, complexity, and rapid change. Universities can therefore no longer focus primarily on transmitting disciplinary knowledge; they must also enable students to act competently, responsibly, and self-

* Corresponding author
E-mail address: Gerhard.Goetz@mosbach.dhbw.de

organised in open-ended contexts. This shift has intensified the relevance of Future Skills in research, policy debates, and institutional development (Ehlers, 2020; OECD, 2019).

This challenge is particularly visible in dual higher education. Dual study programmes are designed to connect academic and workplace learning, yet the degree and quality of integration between these learning sites often vary considerably and may leave students with a substantial "transfer burden" in creating coherence themselves (Mordhorst & Jenert, 2023). At the same time, this very structure makes dual programmes a highly relevant arena for Future Skills development: they offer authentic, iterative experiences across contexts, but they also require carefully designed pedagogical and curricular arrangements to transform experience into competence development.

Against this background, the relationship between Future Skills, digital literacy, and computer science competences requires greater analytical clarity. In this paper, Future Skills are understood as broader action-oriented competences that enable self-directed, reflective, collaborative, and responsible action under conditions of uncertainty and emergence (Ehlers, 2020). Digital literacy refers to the reflective, critical, and purposeful use of digital environments, information, and tools in learning and professional contexts. Computer science competences, in turn, denote more foundational technical-conceptual understandings such as algorithmic logic, data-related thinking, and knowledge of digital systems. The three domains are closely related, but they are not identical: Future Skills constitute the broader competence horizon, digital literacy functions as a transversal enabling domain, and computer science competences represent a more specific foundational component within technology-related competence development.

This paper assumes that these three domains should not be treated separately if higher education aims to respond adequately to contemporary transformation pressures. Rather, they need to be analysed in relation to one another and in relation to university development and programme design. This is especially important because this integrative perspective often recedes behind isolated curricular initiatives or stand-alone support offers. To address this gap, the paper brings together three interdisciplinary mini case studies that examine competence development from different but connected angles: (1) curriculum-integrated Future Skills development in dual higher education, (2) digital literacy as a transversal enabler of Future Skills, and (3) foundational computer science competences as a component of data- and technology-related Future Skills. Taken together, the cases allow not only individual description but also analytical comparison with regard to common goals, different mechanisms, and transferable design principles.

Methodologically, the paper therefore follows an interdisciplinary multiple case study approach with a comparative perspective. The individual cases differ in context, target group, intervention format, and empirical basis; these methodological differences are addressed within the respective case descriptions because they are integral to understanding how competence development is supported in each setting. At the same time, the cases are linked by a shared analytical lens: all examine how competence-oriented learning arrangements can be designed to support future-oriented learning in higher education. The purpose of the cross-case perspective is not to collapse differences, but to make visible where the cases converge, where they diverge, and which insights may be transferable across contexts. In doing so, the paper distinguishes between empirical data, theory-informed design rationales, and reflective implementation insights, and uses these different forms of material for distinct analytical purposes. Guided by this integrative perspective, the paper pursues the following research questions:

1. How can Future Skills be meaningfully integrated into higher education curricula across diverse disciplinary and institutional contexts, especially in dual study programmes?
2. What roles do digital literacy and computer science competences play as enabling or constitutive elements of Future Skills development?
3. Which pedagogical design principles and learning environments support sustainable competence development across the three domains?

This section offers a structural overview by outlining the subsequent chapters, their focus and their relation to the previously introduced research questions. Chapter 2 introduces the methodological framing and the shared analytical lens used to relate the cases to one another. Chapters 3 to 5 present the three case studies which take a deliberately tiered analytical perspective

on skills development in higher education. Chapter 3 examines the meta-level of future skills as an overarching orientation framework for learning and teaching requirements in the context of digital and social change, thereby addressing research question 1. Building on this perspective, chapter 4 explores digital literacy as a central component of this broader competence spectrum, while chapter 5 focuses on computer science and IT-related competences as more specialised forms. Both chapters contribute to addressing research question 2. Together, the case studies outline a conceptual development process from general future competences to domain-specific digital literacy to sound computer science competences. With regard to research question 3, a concluding synthesis summarises cross-case insights, identifies convergences and divergences, and discusses their implications for programme designs, institutional development, and the transferability of competence-oriented approaches in higher education.* The results for all three research questions are presented in chapter 6.1. Chapter 6.2 concludes with an outlook on future work.

2 Methodological Framing

2.1 Conceptual definition of Future Skills (analytical lens)

This study adopts a competence-theoretical understanding of Future Skills as action-oriented competences that enable individuals to deal with complex problems in highly emergent contexts in a self-organised manner (Ehlers, 2020). In this perspective, competences cannot be reduced to isolated skills; rather, they are dispositions to act that become visible in situated performance and develop over time through experience and reflection (Weinert, 2001; Ehlers, 2020).

To make this shared analytical lens explicit for the cases and the subsequent cross-case synthesis, Figure 1 is positioned in this section. It serves as a common reference frame for mapping the competence focus of each case, comparing how different interventions address competence development, and relating the cases across learning sites, formats, and didactic mechanisms. In this way, the figure does not merely illustrate the theoretical background, but provides the conceptual bridge between the individual case descriptions and the comparative discussion.

This conceptual positioning is deliberately integrative, but it does not treat Future Skills, digital literacy, and computer science competences as interchangeable concepts. The literature uses partially overlapping terms such as Future Skills, transversal competences, key competences, digital competences, digital literacy, AI literacy, and computer science competences, yet these approaches differ in their normative orientation, domain specificity, and underlying model of learning. While some emphasise employability and labour-market relevance, others foreground agency, sustainability, participation, or personal development.

Against this background, the paper assumes a layered relationship: Future Skills provide the broader educational horizon of self-organised, reflective, collaborative, and responsible action under conditions of uncertainty; digital literacy functions as a transversal enabling domain within this horizon; and computer science competences form a more specific foundation for understanding, evaluating, and shaping digital systems. This positioning addresses a central tension in the field: broad Future Skills frameworks require concrete pedagogical and disciplinary translation, while digital and computer science competence models risk remaining too narrow if detached from questions of agency, responsibility, reflection, and transformation.

* This manuscript was edited with the support of ChatGPT and Claude exclusively for language revision and text refinement; all intellectual contributions, conceptual decisions, and full responsibility for the content remain with the authors.

CC BY NC

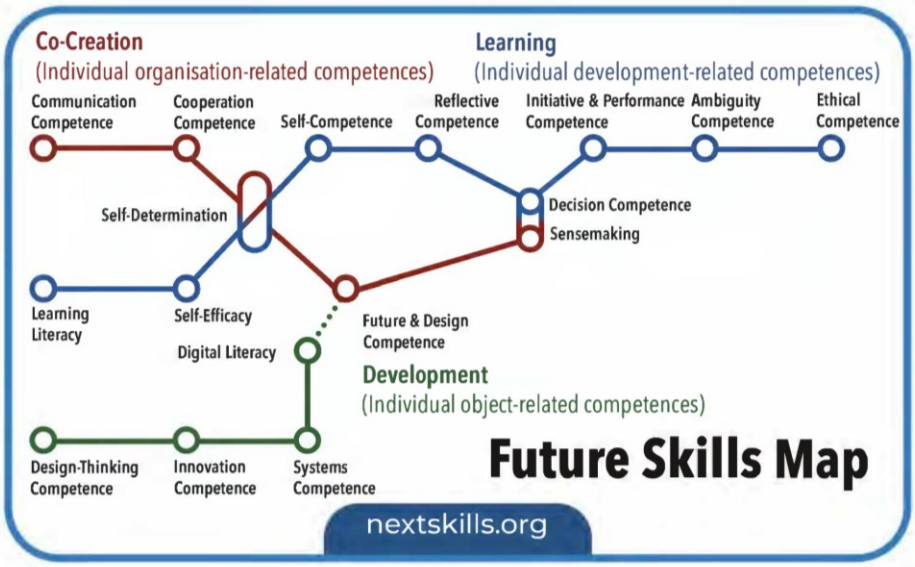

Figure 1. NextSkills Competence Framework

2.2 Research design: An interdisciplinary multiple case study approach

Methodologically, the paper follows an interdisciplinary multiple case study design, using three mini case studies as analytically comparable units. Case study research is particularly appropriate when complex educational phenomena are examined in context while preserving the richness of authentic settings (Stake, 1995; Yin, 2018; Merriam & Tisdell, 2016). The aim is not statistical generalisation, but analytical insight into how competence-oriented interventions are designed, embedded, and reflected upon in different higher education contexts.

The unit of analysis is the competence-oriented educational intervention within its institutional and pedagogical context. Each case is therefore treated not as a complete institutional case, but as a bounded intervention case: Case 1 focuses on a curriculum-integrated Future Skills programme in dual higher education; Case 2 focuses on a modular online course for digital literacy; and Case 3 focuses on a preparatory blended-learning course for foundational computer science competences. The cases are comparable because each addresses the design and implementation of learning arrangements intended to support future-oriented competence development in higher education. At the same time, they differ in disciplinary location, target group, implementation maturity, empirical basis, and degree of curricular integration.

This distinction is important because the paper combines empirical evidence, design rationale, and reflective documentation. Empirical data are understood as systematically collected materials such as survey results, Delphi findings, evaluation data, and participant feedback. Design rationales refer to the theory-informed reasons for selecting specific pedagogical formats, tools, or competence models. Reflective documentation comprises structured observations and lessons learned during development, implementation, and scholarly exchange. These three types of material are not treated as equivalent evidence. Rather, they serve different analytical functions: empirical data support claims about participants' perceptions, needs, or expert judgements; design rationales explain why particular interventions were constructed in a specific way; and reflective documentation helps interpret implementation conditions, limitations, and transferability.

The three cases are comparable because they address a shared problem space: the development of future-oriented competences in higher education. More specifically, they (1) focus on competences that go beyond narrow disciplinary knowledge, (2) operate at the interface between curricular structures and transversal support formats, (3) rely on students' active engagement and self-directed learning, and (4) require adaptation to specific institutional, disciplinary, and learner-related conditions. The cases are therefore not methodologically standardised, but systematically

related through a common analytical lens. This allows the paper to preserve the specificity of each intervention while making cross-case patterns visible.

Due to the fact that the case studies are performed at different levels of development, their presentation differs to some extent within this work: While the Future Skills framework has been established for some time, the foundations of digital literacy and computer science competences have been adapted more recently to our university and therefore we present more detail on the research that informed their development. The cases were developed and refined through interdisciplinary scholarly collaboration in a symposium format, involving perspectives from educational science, competence research, computer science education, and higher education didactics. This process helped establish a shared analytical language while preserving domain-specific depth.

2.3 Relation to design-oriented educational research

Beyond descriptive case reporting, the study is informed by principles of Design-Based Research (DBR), as all three cases centre on interventions that were designed for authentic educational settings and iteratively developed through reflection and evidence. DBR is commonly described as linking theory-informed design with systematic inquiry in practice in order to generate context-sensitive design principles and explanatory insights (Design-Based Research Collective, 2003; Wang & Hannafin, 2005). In this paper, DBR serves less as a strict methodological protocol than as an orientation for relating intervention design, implementation, and learning-oriented refinement across cases.

2.4 Data sources, cross-case synthesis, and quality considerations

Across the cases, the empirical materials include, depending on the case, expert-based Delphi results, formative evaluation data from intervention implementations, design rationales, and reflective documentation from development processes. The cross-case analysis follows a comparative interpretative logic and focuses on three guiding dimensions: (1) common pedagogical design principles and learning mechanisms, (2) context-specific enabling conditions and barriers, and (3) the role of digital literacy and computer science competences in relation to broader Future Skills outcomes. This comparative perspective is intended to make convergences, divergences, and transferable insights across the three cases more explicit.

The cross-case synthesis was conducted in three analytical steps. First, each case was reconstructed individually with regard to its competence focus, intervention design, data basis, implementation context, and stated limitations. Second, the cases were compared along three guiding dimensions: (1) pedagogical design principles and learning mechanisms, (2) enabling conditions and barriers in the respective institutional and curricular contexts, and (3) the relationship between Future Skills, digital literacy, and computer science competences. Third, convergences and divergences were interpreted with regard to their transferability beyond the specific institutional setting.

The comparison therefore did not aim to identify one uniform model of competence development. Instead, it asked how different interventions make future-oriented competence development possible under different conditions. This comparative logic is particularly relevant because the three cases represent different levels of competence development: the first case addresses Future Skills as a broad institutional and curricular orientation; the second case focuses on digital literacy as a transversal enabling domain; and the third case examines foundational computer science competences as a more specific technical-conceptual component. The cross-case synthesis thus follows an interpretative and theory-informed logic rather than a purely aggregative one.

To enhance transparency, the analytical status of claims is differentiated throughout the paper. Claims based on empirical data are presented as findings from surveys, Delphi procedures, evaluations, or participant feedback. Claims based on design decisions are framed as design rationales or pedagogical assumptions. Claims based on implementation experience are presented

CC BY NC

as reflective insights and are discussed with regard to their limitations. This distinction strengthens the methodological robustness of the paper by clarifying what counts as data, what counts as theoretically informed design reasoning, and what counts as reflective interpretation. The credibility of the synthesis is supported through transparent case descriptions, triangulation across materials where available, and explicit articulation of limitations and scope (Yin, 2018; Merriam & Tisdell, 2016).

3 Case Study 1: Integrating Future Skills into the curriculum

3.1 Theoretical background and setting

Ongoing processes of societal transformation are not only changing societal and professional contexts, but also the structures and self-understanding of higher education institutions. Universities are therefore confronted with the task of actively shaping this transformation and enabling students to participate in it in a reflective and responsible way. From an educational-theoretical perspective, the aim is not merely to equip students with knowledge for foreseeable situations, but to support them in developing dispositions that allow them to act in open, uncertain and dynamically changing contexts, navigate complexity, collaborate effectively, and drive social change. In this context, the concept of so-called Future Skills is becoming extremely significant. These competences are often discussed in research and European policy debates as “transversal skills” (García-Álvarez et al., 2022) “sustainability competences” or “green skills” (Bianchi et al., 2022). Despite their different emphases, these approaches share a common objective: they seek to prepare students to engage constructively with future challenges and to remain capable of acting in, and shaping, situations characterised by uncertainty, ambiguity and transformative change (Ehlers, 2020). This calls for an updated understanding of learning environments that foster participation, learner agency and self-directed learning, and that understand students as active co-creators of their own educational processes as well as societal and technological change. Providing such learning opportunities for students is a challenge that universities must rise to.

3.2 Project [A]

The project [A] builds on the premise that dual study programmes provide a particularly favourable learning environment for iterative competence development, given their structured alternation between academic and workplace phases. The two-year programme, informed by prior conceptual work and evaluation studies conducted at the university, aims to strengthen the integration of theory and practice and to deepen students’ reflective engagement with Future Skills by fostering self-directed and reflective learning, grounded in their real-world experiences. Therefore, the project designs a curriculum-integrated, multi-stage Future Skills programme, consisting of various learning materials and didactic concepts. In addition, a peer-circle-based digital competence ePortfolio is implemented to extend competence development into a continuous reflective process, using the experiences students gain within their partner organisations. Before presenting the individual learning materials and instructional formats, we outline key design principles for learning environments that effectively support the development of Future Skills.

3.3 Learning theory background and didactic approach to the concept

In addition to the core idea of shifting from isolated learning episodes to a continuous reflection flow that fosters competence development over time, the project’s approach draws on a set of complementary learning-theoretical perspectives. Taken together, these elements can be understood as key prerequisites for competence development within our Future Skills approach, which conceptualises Future Skills as action competences and thus forms the conceptual and didactic foundation of the Future Skills programme.

Kolb’s (1984) experiential learning model describes learning as a four-stage cycle that helps students become more aware of their own learning processes. The learning cycle begins with

concrete, personally relevant experiences, which are then subjected to self-reflection, analysed to identify patterns and insights. Finally, learners translate these insights into adapted action in practice; this modified action generates new experiences and thereby reinitiates the cycle. A second central learning-theoretical foundation for competence development that underpins the project [A] dual-learning approach is Donald Schön's (1983) concept of the reflective practitioner. Schön distinguishes between two forms of reflection: reflection-in-action, in which individuals reflect and make adjustments while performing an activity, and reflection-on-action, in which they review and analyse their actions subsequently. Students are encouraged to develop their Future Skills in a similar way: by making their implicit knowledge explicit, considering alternative courses of action in specific contexts, and formulating small, personal theories of action. External learning stimuli, particularly in the form of feedback, further enrich this reflective process. Yan and Boud (2022) highlight the importance of formative feedback for the competence development of students, arguing that feedback is most effective when it supports learners in monitoring, regulating and reorienting their own learning rather than merely evaluating learning outcomes (summative feedback). Accordingly, the concept also places a strong emphasis on peer learning processes and peer feedback during the workshops and throughout the semester to ensure external feedback on the competence development. Within this framework, the learning design is explicitly strengths-oriented and informed by positive psychology (Seligman & Csikszentmihalyi, 2000) as well as grounded in situated authentic learning settings (Mandl & Krause, 2001). Students are therefore encouraged to identify personally successful action situations and to analyse these experiences through the lens of the Future Skills competence structure model. Operationally, this Future Skills learning design aligns with Kovalcik's (2019) four-step progression of competence development, which moves from the need to name and define Future Skills to building awareness and identifying personally meaningful competences, linking them to lived experience, and finally articulating and transferring them across different contexts.

3.4 Previous evaluation results of the Future Skills learning intervention

Findings from prior pilot implementations indicate that the Future Skills programme was rated as important and helpful by a large majority of participants and was met with high levels of student interest and acceptance, underscoring the relevance of the underlying pedagogical concept (Authors 1). In an evaluation of the first piloting of the Future Skills learning intervention, outcomes were assessed, using a standardised online questionnaire (n=744 students) that was distributed to students at the end of a Future Skills introductory workshops across different study programmes and faculties. The survey comprised 30 items and used a five-point Likert scale, included sociodemographic data, and captured four dimensions: (1) acceptance of the pedagogical approaches, (2) students' reactions/learning efficacy, (3) perceived individual relevance of the content, and (4) perceived academic self-efficacy.

Most students rated Future Skills learning as important (83.4%) and stated that the workshop was helpful in familiarising them with the concept of Future Skills (85.2%) (ibid.). The content was also seen as personally relevant: 63.1% reported that the workshop helped them identify Future Skills that are personally meaningful. Students linked the relevance of Future Skills mainly to career development (75.0%) and personal development (74.5%), which supports integrating such learning into the curriculum (ibid.) Students located the importance of Future Skills primarily in relation to career development (75.0%) and personal development (74.5%), reinforcing the case for curriculum integration (ibid.). Consistent with this, demand for further Future Skills learning opportunities is high, especially in study-integrated formats, with a dichotomised approval rate of 68.5% (ibid.). Although the findings reflect an intervention rather than a fully scaled programme and are situated in a dual-study model, they nevertheless allow for strong conclusions regarding the quality of the intervention design and its suitability for fostering Future Skills.

CC BY NC

3.5 Consequences for Future Skills Learning Designs

The evaluation results emphasise the importance of Future Skills and indicate a clear need for integrating Future Skills concepts more systematically into the dual-study curriculum. This implies a transformational shift in the way dual study programmes are designed, requiring the implementation of tailor-made learning formats that enable students to develop Future Skills autonomously and self-organised in order to successfully navigate a world of rapid change. In line with this, students explicitly call for more, and especially more visible, Future Skills learning opportunities throughout their studies. Consequently, learning designs should create favourable learning environments for Future Skills development, for example through peer feedback, continuous reflection flows, formative feedback, and authentic real-life experiences in situated learning settings.

3.6 Context at the university

To date, no integrated cross-campus Future Skills programme has been established at our university – for several reasons and because of barriers such as the complexity of decision and university-wide IT integration processes for the digital solutions such as apps and portfolio tools, the fragmentation of the university across campuses and locations, the variety of study programmes, dual partner organisations, accreditation processes or structures of theory and practice phases.

The Future Skills programme within project A is situated in a context characterised by heterogeneity - which, put positively, also gives room for exploration, experimentation and for trying out new approaches to design a modular Future Skills Programme for dual study pathways in an agile and participatory way, tested in educational practice contexts. One consequence is that, even in an exploratory mode, there cannot be a one-size-fits-all approach for Future Skills learning. The solution to be piloted is a Future Skills Toolbox for students and lecturers combined with a counselling process. The toolbox was developed in a design-based research process, involving students, the project team and dual practice partners.

3.7 Selection and counselling process

For testing new approaches, the team needed to find room for piloting in existing study programmes - with study coordinators willing to contribute to the further development of the programme and to integrate the resources and approaches increasingly into their own courses and programmes. For this purpose, an open call for participation was launched within the university, complemented by two digital information sessions. Nine study programmes from four campus locations and three faculties were selected in study programmes in the faculties of Business, Social Work, and Health. Several more study coordinators will participate in a more lightweight scenario in the next year. From the applicants, the participating study programmes were selected according to their range of disciplines, motivation to further develop and pursue the concepts during and after the piloting and to contribute to its evaluation and adaptation. The piloting will take place for first-, second- and third-year students.

The study coordinators were invited for one or several counselling sessions which aimed at collaboratively designing an adapted Future Skills programme from the Future Skills toolbox and addressed the following aspects:

- status quo of the study programme:
    - relevant topics and challenges
    - relevant FS-related topics and important Future Skills
- shared objectives
    - Motivation for participation
    - relevant aspects to consider for a successful cooperation and a meaningful learning experience
- conception phase
    - Which Future Skills-relevant elements are already established and how can they be connected to/combined with the toolbox?

  - Opportunities and barriers for integration
  - Which tools shall be used?
  - first ideas for implementation
  - involvement of Dual partners
  - Integration into the study year: dates, etc.
- Conclusion
  - open questions
  - Agreements and next steps

3.8 Toolbox and scenarios

In the counselling process, there is a certain freedom for adaptation, but also a minimal requirement of mandatory formats from the various elements of the Future Skills Toolbox (figure 2): a basic workshop for getting to know the concept and relevance of Future Skills and discovering one's own Future Skills profile, e.g. by implementing a general or adapted version of the Future Skills Compass as a reflection tool, as well as an introduction to the digital tools for self-directed learning, several reflection check-in meetings and a final workshop for taking stock of the Future Skills learning progress.

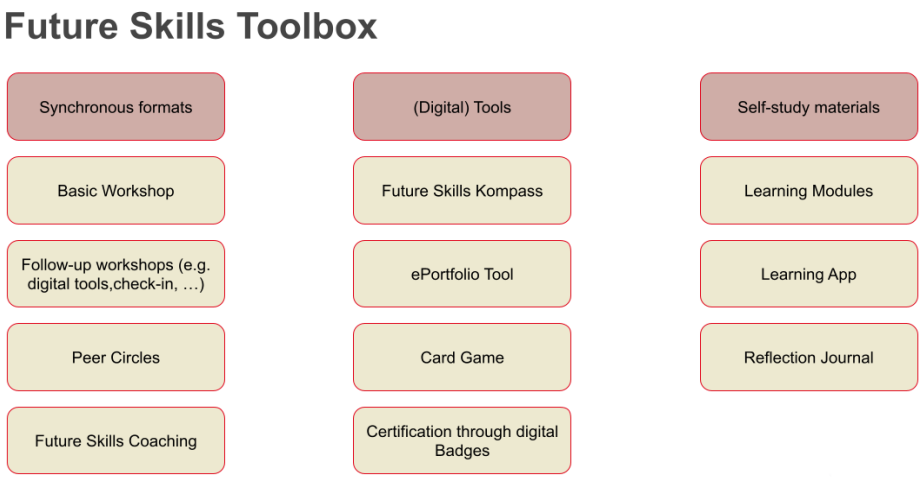

Figure 2. Future Skills Toolbox

A voluntary monthly coaching offer across participating as well as regular meetings with participating study coordinators and resources for dual partners and educators as well as a Moodle room, an ePortfolio tool for continuous documentation of Future Skills learning experiences, a learning app etc. complement the toolbox, allowing it to be tailored to course-internal and individual learning needs and contexts. Many activities take place in small peer circles of around four students which support one another in their Future Skills learning journey. Furthermore, a group coaching offer will be piloted in the second project year.

In the course of the counselling and conceptualisation processes, several different scenarios (cf. figure 3) have been developed, e.g.:

- the structured scenario: specific dates and scheduled times for self-study with scheduled "homework" for pacing of reflection
- the networked scenario: three participating courses from the same programme with different years, approaches and implementations, but shared resources such as an adapted version of the Future Skills Compass
- the innovative scenario: students develop resources and presentations on Future Skills and their discipline and present them in a final conference

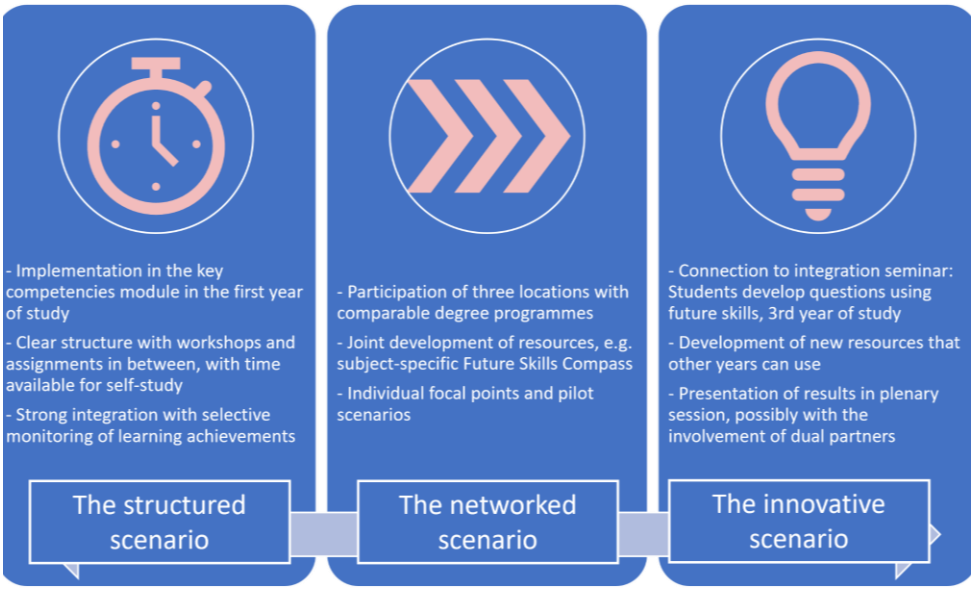

Figure 3. Different scenarios of integrating the Future Skills programme

3.9 Involvement of dual partners

At our university, dual partners employ students and also provide the practical learning space for dual students. Their role in the Future Skills learning process of students is crucial as most practical experiences take place during the learners' practice phases. Ideally, Future Skills learning would include reflection spaces and impulses both at the university and the workplace in an integrated and continuous way. However, involving dual partners in the Future Skills programme poses challenges: in some courses, students work and study at a multitude of different dual partners of various sizes, some of them explicitly fostering Future Skills through their own programmes. An info sheet was developed to be sent to dual partners by the study coordinators, providing some low-threshold ideas for supporting dual students' Future Skills development and inviting interested persons to become part of a community of practice for Future Skills development at the workplace. Moreover, some study coordinators explicitly involve persons from dual partners in the programme who are lecturers already.

3.10 Learnings for other contexts

While the Future Skills programme is being implemented in a specific dual study setting across different campuses and study programmes, several transferable insights can be derived that can inform the design and implementation of Future Skills initiatives in other contexts:

- While a shared competence framework is advised for orientation and developing a shared language with regard to Future Skills, there is no single uniform approach: Future Skills must be contextualised within the respective discipline in order to be seamlessly integrated.
- Continuous reflection and integration remain a challenge in intense study programmes with full curricula and little time for self-directed and interest-led studies as well as feedback processes. The integration of smaller reflection units as well as the use of digital tools can be a solution to extend the reflection impulses across theory and practice phases.
- The sustainability of the Future Skills challenge must be continuously discussed with involved educators and coordinators. Ideally, students, dual partners and other educators in a study programme are trained to support Future Skills development in their respective contexts.

Limitations of the case study are the (currently limited) availability of qualitative data and up-to-date quantitative data with regard to the current learning interventions taking place. These will be collected in the near term. Furthermore, the findings relate to a specific model of dual studies characterised by alternating theory and practice phases. Transferability to other study contexts must be critically discussed, especially in cases without close contact with industry partners.

4 Case Study 2: Digital Literacy as a key to developing transversal Future Skills

4.1 Theoretical background and setting

Digital literacy is now a key requirement for successful educational processes in universities and forms a core area of future-oriented academic skills development. However, its importance extends far beyond technical skills (Klier et al., 2021; Krempkow, 2021; Petri et al., 2024). In the context of current models such as the NextSkills Framework (Kirchherr et al., 2018), digital skills – including the IT skills identified therein – not only function as a separate cluster of skills, but also act as enablers for other Future Skills such as self-directed learning, critical thinking and collaborative working. Higher education research projects show that the promotion of digital competence – among students and teachers alike – can have a transformative effect when supported by didactic interventions (Authors 2; Hattermann et al., 2021).

The [B] model (Figure 4) was developed in a university-wide research process that included an empirical survey of teachers at various locations of our university (Authors 3). The five core areas of literacy – basic computer literacy, information literacy, media literacy, digital identity and career planning – are based on both university-specific requirements and reference frameworks such as the JISC Digital Literacy Framework (Holdener, Bellanger & Mohr, 2018).

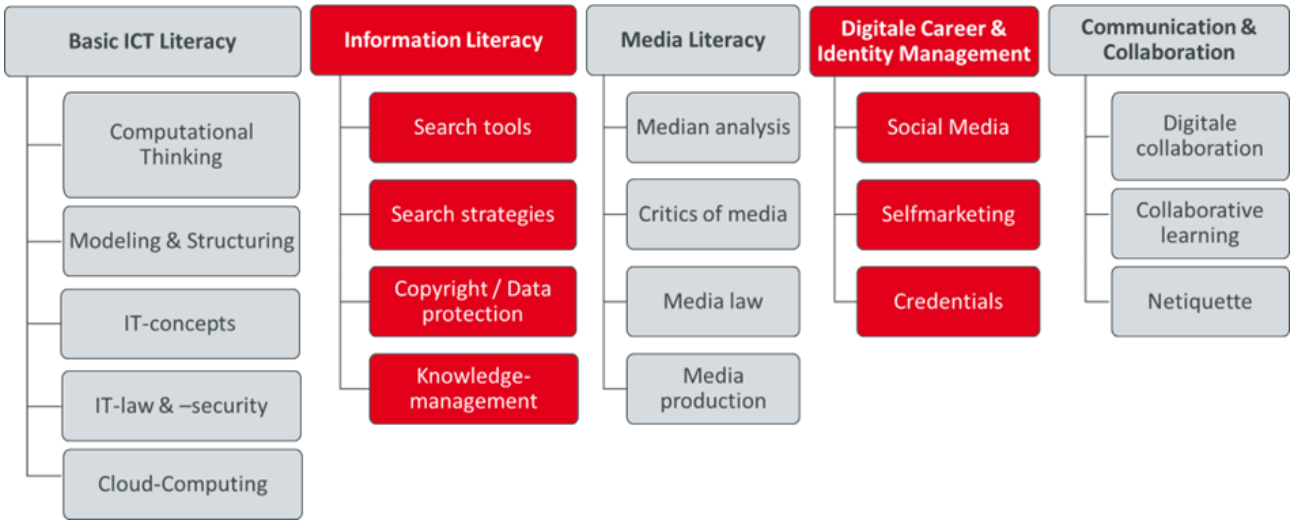

Figure 4. [B] - Aspects of Digital Literacy in students' education

In order to put this theoretical basis into practice, a modular, flexible online self-study course was developed (Authors 4). This course is designed to be used in a variety of teaching and learning scenarios – from voluntary self-study and blended-learning concepts to face-to-face formats such as preliminary courses or accompanying tutorials. The didactic design follows principles of both activation and competence orientation and uses digital learning formats (H5P elements, videos, interactive additional information, etc.). The aim is sustainable competence development that goes beyond the mere acquisition of knowledge.

4.2 Contents and didactic structure

The online course comprises four thematic modules that address different dimensions of digital literacy and also represent key areas of the [B] model. The topics are selected based on the results of a university-wide lecturer survey conducted in December 2022 (Authors 3). The course is designed to be a dynamic format that is continuously developed and adapted to the ongoing evolution of digital topics. As a result, the course content is constantly growing in line with the requirements of digital literacy, which are becoming increasingly complex and diverse. It is important to note at this point that the content is licensed under CC licences, so that existing, curated content could be used and adapted to individual needs. Although the topics covered in the course can be chosen freely by the users in any order, a particular focus during development was placed on basic computer science literacy. It is assumed that the confident, critical, and creative use of information and communication technologies benefits significantly from a fundamental understanding of how computers work and the principles of computer science (Koubek, 2005, p. 63).

The basic IT literacy module forms the technical core. It provides a fundamental understanding of digital systems, thereby laying the foundation for more advanced skills. The first lesson introduces the structure of computers, explains key components such as processors, memory and input/output devices, and traces the historical development from early computers such as ENIAC to modern mobile devices. The second lesson is devoted to human-computer interaction (HCI), analyses design principles of user-centred interaction independently of specific programming languages, and illustrates how technical systems are aligned with human perception and practical action. The module aims to enable students not only to use digital technologies functionally, but also to understand their basic logic. The intention is to strengthen learners' comprehension of programming operations and underlying algorithmic logic through the use of visual representational methods, particularly flowcharts (figure 5). Such visualisations support an accessible, language-agnostic engagement with computational procedures and are therefore considered a beneficial didactic resource in academic instruction (Schnirch et al., 2020; Kämper, 2003).

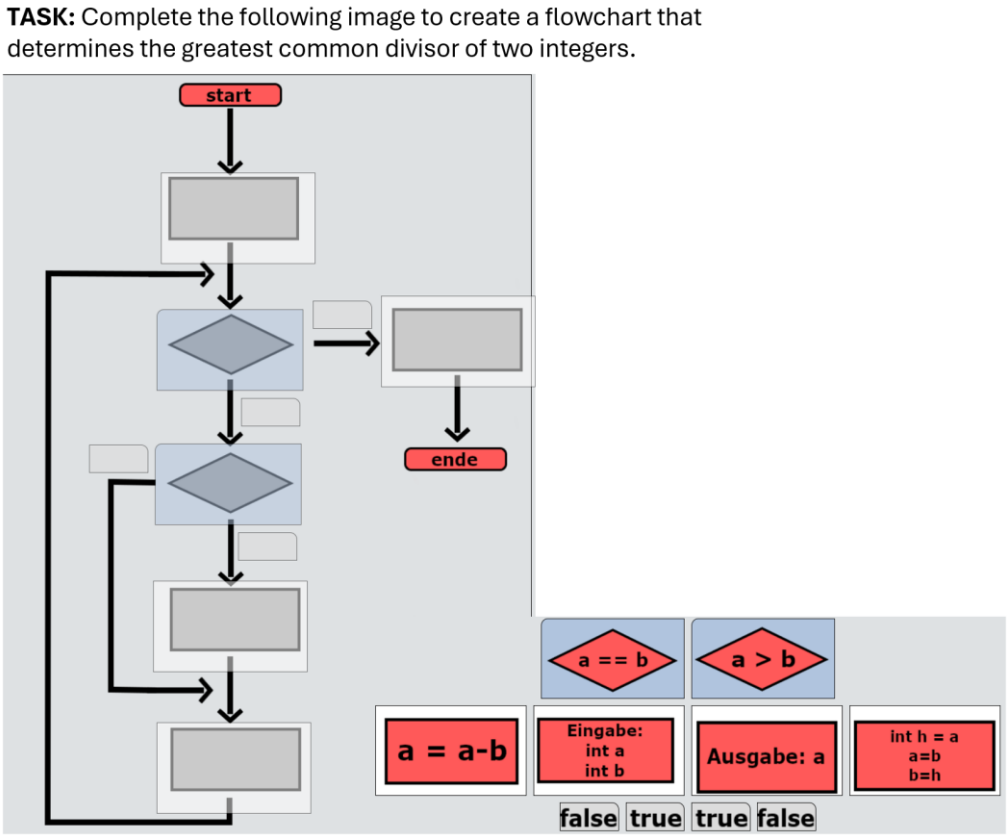

Figure 5. Algorithmic logic through the use of language-agnostic engagement

The information literacy module complements this technical foundation with the ability to use information spaces safely and reflectively. Topics covered include strategies for risk recognition, personal data protection, digital identity design, and security-conscious behaviour in everyday life. In addition, skills that are central to academic work are taught: information retrieval, source evaluation, structuring of research processes, and critical reflection on digital content. Information literacy is thus understood as a combination of digital security, media criticism and scientific information practice. The content of this lesson originates from the course “Schulung des Informationsbewusstseins” (information awareness training) - developed by Heilbronn University, Mannheim University, Reutlingen University, Freiburg University of Education, Karlsruhe University of Education, Weingarten University of Education, Esslingen University, and the DHBW (Cooperative State University Baden-Wuerttemberg) in collaboration with the Hochschulzentrum Baden-Württemberg. The overarching aim is to enhance awareness of potential risks and to equip learners with strategies for robust protection.

A central and highly topical module is AI competence for study and research. It teaches the basic functioning of artificial intelligence, explains the opportunities, risks and limitations of these technologies, and addresses questions of ethics and responsibility in particular. Students learn to critically evaluate AI systems and use them reflectively in academic processes – for example, in literature research, structuring scientific texts, analysing data, or reflecting on epistemic premises. A central objective of this module is to enable students to use AI in an informed and responsible manner, rather than adopting it uncritically or avoiding it out of uncertainty. It thus makes a significant contribution to the development of digital sovereignty.

The fourth module, digital reading literacy, addresses an area that is becoming increasingly important in the digital transformation. Digital reading literacy encompasses skills such as self-regulated reading, metacognitive control, critical comparison of multiple sources, and the ability to be epistemically vigilant. Students learn to strategically access digital texts, assess information quality, recognise cognitive biases, and consciously navigate digital information architectures. This makes digital literacy a key skill in academic work and in dealing with complex information environments.

The decision to map AI literacy and digital reading literacy as separate modules is based on two considerations: Firstly, both topics overlap with several areas of literacy in the [B] model – they encompass aspects of IT, information and media literacy as well as overarching reflective skills. Assigning them to a single area would not adequately reflect this complexity. Secondly, these are two areas of competence that are particularly prominent and dynamically growing in public and academic discourse, justifying in-depth, separate treatment. Presenting them separately allows for a clear focus on content and helps students to engage with these cross-cutting topics in a targeted manner. The implementation of this course has recently been completed and is starting to be used by students in the winter term 2025/26. For this reason, no evaluation data are yet available. One key focus will be the understanding of the role of guidance and supervision that might be needed in order to support the students’ learning process best.

4.3 Reflections on limitations and scope of the case study “Digital Literacy”

While the case presented illustrates how digital literacy can act as a catalyst for the development of transversal Future Skills, several limitations must be taken into account in order to contextualise the results appropriately. First, the case is set in a single university offering dual education. The institutional environment is characterised by specific organisational structures, curricular traditions, and support mechanisms. The transferability of the approach described to other higher education contexts is considered very positive, however, empirical testing in other contexts has not yet been carried out. The willingness of the institution and the teaching staff, the available resources, and local educational cultures can significantly influence both the implementation processes and the learning outcomes. Second, the empirical basis of the present case study is currently still limited in terms of reliability. As already mentioned, the course was only recently implemented, so no systematically collected evaluation data are available yet. The analysis is therefore based primarily on didactic design principles and previous institutional experience with comparable teaching formats, rather than on validated outcome measures. Future research should

CC BY NC

therefore include longitudinal data collection, structured evaluation procedures, and comparative analyses in order to empirically substantiate statements on learning effectiveness and the development of subject-specific and interdisciplinary skills.

Thirdly, methodological limitations arise from the exploratory nature of the intervention. This article emphasises in particular the conceptual alignment between the [B] model presented and existing competence frameworks for Future Skills and digital literacy, but cannot demonstrate conclusive causal links empirically between specific teaching elements and the acquisition of transversal competences. The case should therefore currently be interpreted primarily as a theory-driven and empirically informed development example.

The explicit identification of these limitations helps to clarify the analytical scope of the study and enables transparent classification within current research on university teaching. At the same time, the case points to a key conceptual development: once students have acquired the basic digital literacy that enables them to participate in digital environments in a reflective and responsible manner, the focus in many departments is increasingly shifting to the question of which basic IT skills are necessary for a successful transition to university studies and for engaging with the course content.

This shift forms the content bridge to the following case study, which deals with computer literacy from a complementary perspective. While this section focuses on the institutional development of an online format for promoting digital literacy during the course of study, the following section looks at basic computer science competences that are considered essential in the transition from secondary school to university within a blended learning scenario. The subsequent case study thus broadens the perspective from digitally competent learners to academically prepared students who are able to engage with the conceptual foundations of computer science. At the same time, this provides further in-depth content: from overarching Future Skills to digital literacy to computer science competences as a sound technical foundation for academic work in the digital age.

5 Case study 3: Identifying and fostering key computer science competences as a key component of Future Skills

5.1 Theoretical background, setting and methodological approach

Computer science competences constitute a subset of digital literacy and therefore represent essential components of future-oriented skills (Ehlers, 2020). This section focuses on fostering fundamental computer science competences among prospective students in engineering degree programmes, based on a didactically grounded competency model. It is an example of supportive measures designed for students during the initial phase of their university studies.

First, the methodological approach used to identify relevant computer science competences during the transition from secondary school to university, is described briefly, followed by a presentation of the resulting findings. Subsequently, the didactic intervention designed to promote computer science competences among incoming first-year students, which builds on these findings, is introduced in more detail. This includes an outline of the systematic structure of the learning environment as well as selected excerpts from the course content. In addition, exemplary feedback from course participants is presented and interpreted with regard to the further development of the support programme.

To identify relevant fundamental computer science competences for the transition from secondary school to university, a Delphi study consisting of two survey rounds was conducted with lectures in computer science. (Authors 5) The general methodological procedure is shown in Figure 6.

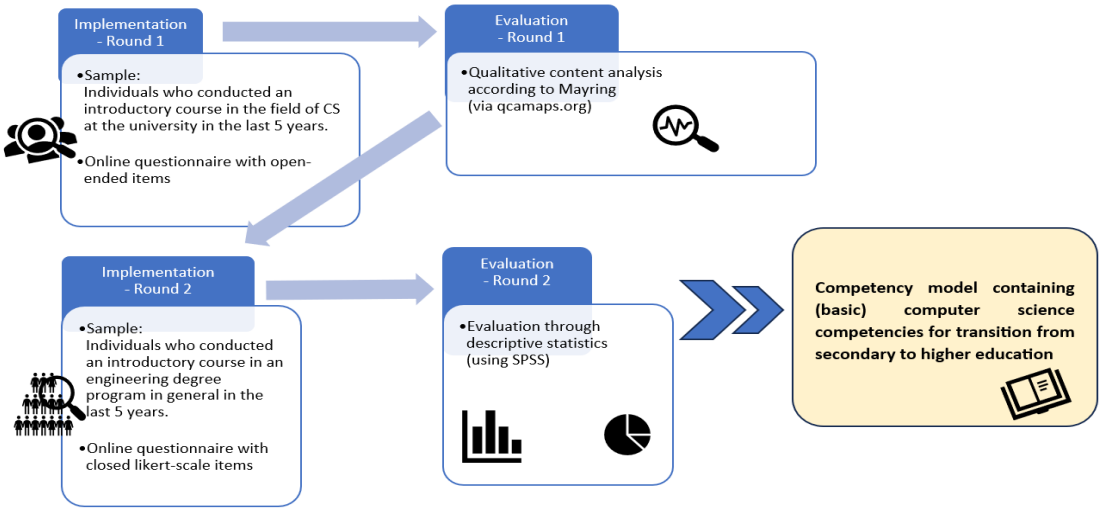

Figure 6. Methodological approach of the two-round Delphi study

In the first expert survey, individuals were asked who had conducted an introductory course in the field of computer science at the university within the past five years. The first survey round was carried out with a narrowly defined respondent group using an online questionnaire and included participants from the Department of Computer Science (e.g., Applied Computer Science, Business Informatics) at the university. The open-ended question items (n=4) are based on the questions used in the previously conducted study "MaLeMINT" (Schröter et al., 2022) and were adapted accordingly for the field of computer science. All items aim to identify relevant computer science competences needed for the transition from school to university. An example question is as follows:

> *„Which computer science competences should first-year students already possess at the beginning of a STEM degree programme?"*

The results of the first survey round were evaluated through a summarising qualitative content analysis based on Mayring's approach. (Mayring, 2022).

In the second expert survey, individuals who had conducted an introductory course in the field of computer science at the university within the past five years were surveyed again. The sample for the second survey round was expanded to include not only teaching staff from the computer science department but also from all other engineering programmes (e.g., Mechatronics, Mechanical Engineering) at the University. The survey was again conducted using an online questionnaire. The questionnaire consists of a large number of closed-ended items that capture both content-related and process-related competences, thereby covering the various subfields of computer science. The individual competences are derived from the computer science competences identified in Round 1, as well as from competency descriptors found in the current curricula of the federal state of Baden-Württemberg for the subjects Computer Science (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2018a, 2018a), IMP (Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2018b), NwT (Ministerium für Kultus, Jugend und Sport, 2023) and in the GI standards. (Hellmig et al., 2024; Röhner et al., 2016) Additionally, the questionnaire was cross-checked with insights from various expert workshops and supplemented in some cases. (Fallböhmer-Koob, 2024; Authors 6) This resulted in a comprehensive competency framework. For each listed competency, the questionnaire asks the following question:

> *„In your opinion, how important is the specified competency "X" for the transition from secondary school to an engineering degree programme?"*

The response options, presented on a 6-point Likert scale, range from *„extremely important"* to *„not important at all"*. In addition, the respondents were asked to rank certain content-related and

process-related areas of competence in order of their overall importance. The evaluation of the questionnaire results is carried out using descriptive statistics.

The following process-related areas of competence were available for selection:

- justify and evaluate
- communicate and collaborate
- present and interpret
- modelling and implementation
- structuring and networking

The following content-related areas of competence were available for selection:

- information and data
- algorithms
- information processing
- computer systems
- data collecting and analysis
- electronic systems
- languages and automata

5.2 Results and their use in developing the competency model: Basic Computer Science Competences for the Transition from Secondary to Higher Education

In the following, the development of the competency model will be presented and explained in some detail (additional information may be found in Authors 7). Figure 7 shows the graphical representation of the competency model of basic computer science competences for the transition from school to university. The model is divided into process-related areas of competence (such as “structuring and networking” – outer circle in figure 7) and domain-specific areas of competence (such as “algorithms” – inner circle in the figure). Each competency area comprises the individual competences assigned to it, which were identified during the two survey rounds.

The individual competences of both areas should not be viewed in isolation from each other. They are closely interwoven during the learning process and are in constant interaction. The individual competences of the process-related competences are formulated independently of specific topics. When combined with various content-related competences from the respective content-related areas, they can be further developed.

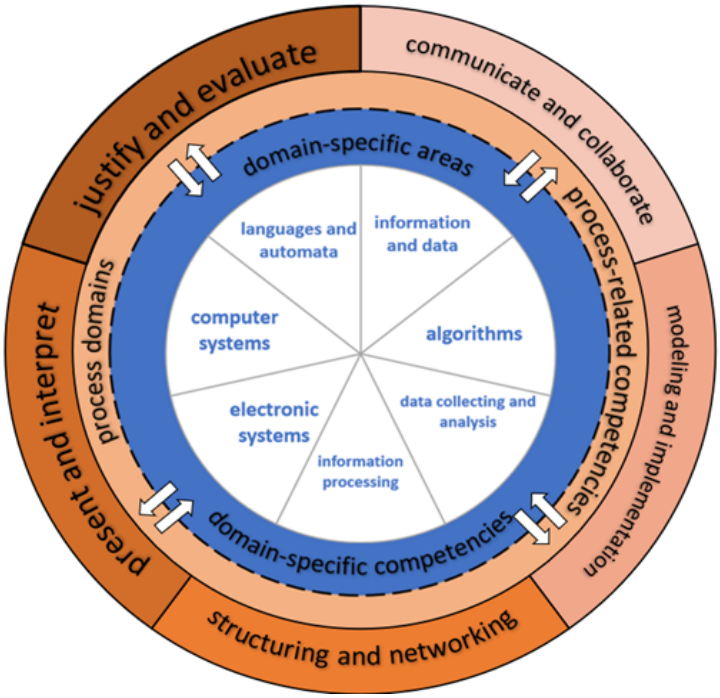

Figure 7. Competency model of basic informatics competences for the transition from school to university

Figure 8 shows the averaged rankings of the content-related and process-related competence areas. Information and data are rated by the experts as by far the most relevant domain-specific competence area for the transition from school to university. Justify and evaluate was considered the most relevant process domain.

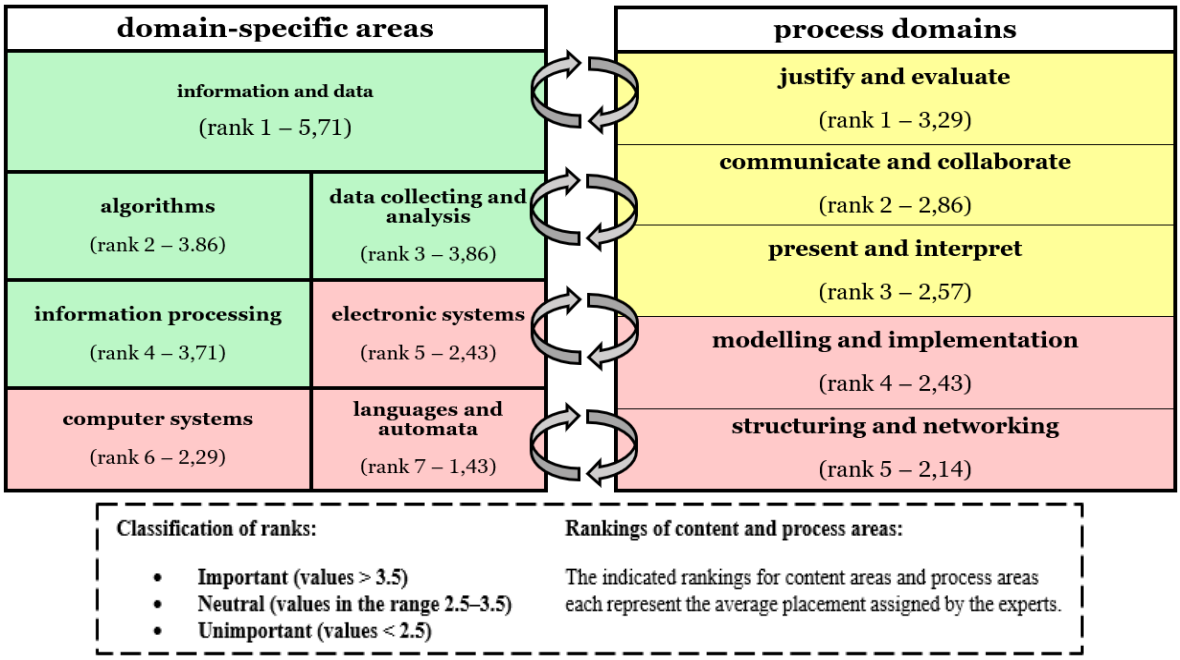

Figure 8. Ranking of the content-related and process-related competence areas (six-point Likert scale)

With regard to the generalisability of the results obtained, limitations must be expected given the size of the sample (n=9) Nevertheless, the findings provide indicative trends for the development of support measures in the field of computer science during the school-to-university transition.

5.3 A brief overview: Key elements of the supportive measure to foster key computer science competences

The preliminary course lasts five consecutive days: During the first two days, fundamental skills and competences in the areas of Python programming and electrical engineering are taught. Over the following three days, participants apply the knowledge gained during the theoretical phase to implement their own project ideas. The learning environment is governed by a high degree of active engagement and independence afforded to the learners. At the same time, the differentiated learning materials provided enable learning at one's own pace and in accordance with individual prior knowledge. This also provides the instructor with the necessary flexibility to provide targeted support to individual participants. In doing so, the instructor adopts the role of a „learning facilitator" and is able to quickly respond to learners' individual questions and difficulties.

The course takes place in person, with participants provided with the necessary technical infrastructure. Desktop computers with internet access are made available for this purpose. The classroom is complemented by digital learning materials, which have been specially prepared on the Moodle platform for independent learning and provide individual learning modules with informational content and differentiating learning tasks. The integrated development environment 'Thonny' is used to create the participants' own programs. This programming environment offers various quality-of-life features, such as a simple debugger, syntax error highlighting, and clear visualisation of variables and their values, which can positively support the learning process when learning how to code.

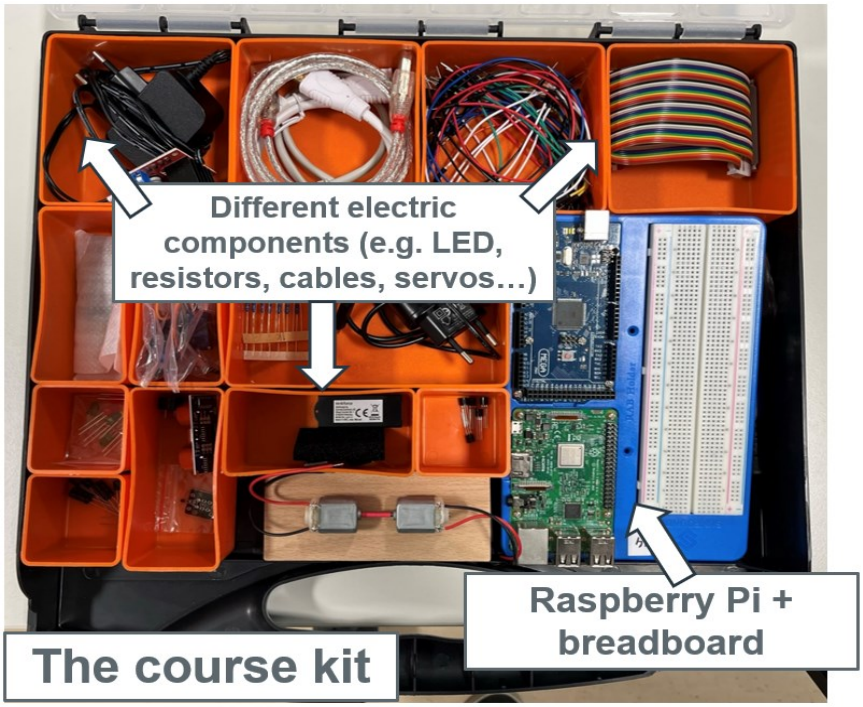

Figure 9. The physical learning materials of the course kit

Central to the learning process are appropriate materials that allow learners to experiment and gain hands-on experience. Figure 9 shows the provided experimental materials for building electrical circuits. These include, in addition to a Raspberry Pi as a programmable single-board computer, common electrical components such as resistors, LEDs, servo motors, and connecting cables.

5.4 Insights and impressions from the course sessions

Over the course of the five days, learners are enabled to implement their own projects largely independently. Looking at the project implementations (as shown on figure 10), it becomes clear that, with the provided resources (e.g., classroom, learning materials, and individual guidance from instructors), participants with little or no prior experience in computer science are empowered to connect computer science content with aspects of electrical engineering.

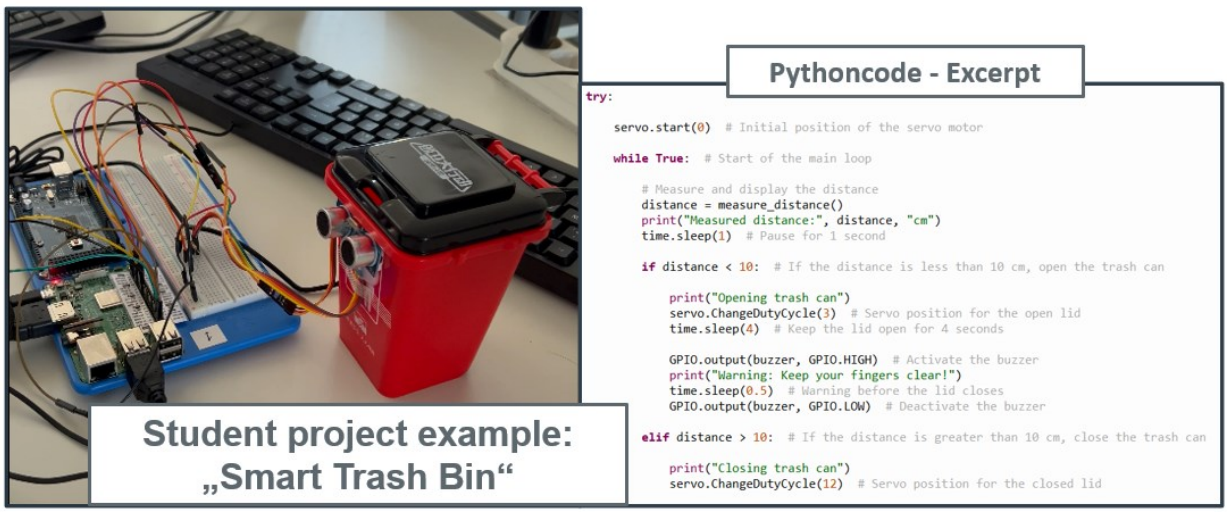

Figure 10. Student project: Smart Trash Bin”

5.5 Feedback from participating students

The implementation of the learning programme is subject to systematic evaluation, on the basis of which the course is continuously developed and improved. The following are frequently recurring examples of feedback comments from the course participants:

- "I really appreciated the high proportion of independent work and learning of the topics discussed."
- "Combination of theory and practice: working independently with a partner, with guidance and explanations available for questions."
- "Being able to apply everything myself and let my creativity run freely in the projects."
- "Independent acquisition of competences and free project work; being able to work at one's own pace."
- "The overall concept and the different selectable difficulty levels."

Consequently, the aspects of „space for independent work / working at one's own pace", „linking theory and practice / applying theoretical content", and the opportunity to „implement one's own project ideas" are particularly highly valued by the participants.

5.6 Limitations of the results

Four main limitations should be noted: First, with regard to the generalisability of the results obtained, limitations must be expected given the small sample size for the two rounds of the Delphi study. Nevertheless, the findings provide indicative trends for the development of support measures in the field of computer science during the school-to-university transition. The latter were evaluated with the course participants.

Second, process-related and content-related competences are closely interrelated. Based on the investigation presented here, no definitive statements can be made about the extent to which certain combinations of process-related and content-related competences are considered particularly relevant. This limitation must be taken into account when interpreting the survey results. Collecting data on relevant combinations within the presented survey would have significantly expanded the scope of an already extensive questionnaire. Therefore, in view of the test's completion time and overall feasibility, this specific perspective was omitted. Likewise, only limited statements can be made about the specific (Bloom's) levels (Krathwohl et al., 1975) at which certain individual competences should primarily be fostered.

Third, the model development and the evaluation have taken place at a single work-integrated university. Therefore, results of this case study may not be transferred one-to-one to other types of universities. Nevertheless, to our knowledge, the preparatory course design for key computer science competences is expected to run as well in other institutions of higher education.

6 Conclusions and outlook

6.1 Conclusions

This paper presented and discussed case studies addressing three related competence fields of Future Skills, digital literacy and computer science. Considered as transversal skills, these domains emerge from the integration of technical, cognitive and reflective dimensions and constitute an important foundation for future-oriented higher education.

The analysis was guided by three research questions, which are addressed here based on the collective insights developed in chapters 3-5. Regarding **research question 1**, chapter 3 examined how Future Skills could be meaningfully integrated into higher education curricula across diverse disciplinary and institutional contexts, particularly within dual study programmes. The case study demonstrates that Future Skills can be institutionally embedded within classical curricula, as their development represents a university-wide responsibility involving both students and teaching staff which requires alignment with curricula and quality assurance processes. The implementation of

CC BY NC

self-directed learning formats shows high potential when supported by appropriate didactic design – verified by the experience gained in the case study Future Skills. In particular, the toolbox concept offers considerable flexibility and adaptability for students, especially those in higher semesters or to other educational contexts. Collaboratively, different explored scenarios for Future Skills learning can serve as a blueprint. As Future Skills subsume many different kinds of competences, the tool box approach turns out to be very appropriate in order to allow selecting the best fitting ones for any given learning situation and setting. From a pedagogical point of view, the reflexive learning process is also strongly supported by the use of supervision, peer activities and ePortfolio.

Research question 2 addresses the role of digital literacy and computer science competences as enabling or constitutive elements of Future Skills development. As a transversal future skill, digital literacy may be considered as a key enabling competence that supports self-directed learning, critical thinking and digital sovereignty. Rather than focusing solely on technical proficiency, digital literacy includes reflective and responsible engagement with digital technologies. In the presented approach, [B] provides a structured, yet flexible competence model that integrates multiple competence dimensions, including basic IT literacy, information literacy, AI literacy and digital reading literacy. The corresponding online course illustrates how theory can be translated into scalable practice. By fostering a foundational understanding of digital technologies, the approach contributes to reducing black-box use and supports interdisciplinary accessibility through language- and tool-independent concepts. Finally, AI literacy and digital reading literacy are emerging key domains.

Computer science competences represent a more specialised and highly relevant subset within this competence spectrum and therefore represent essential components of future-oriented skills. Their strong connection to the practical problem solving makes them suitable for development in hands-on courses within engineering degree programmes, where students apply these competences in authentic project contexts. Such learning environments support not only acquisition of technical knowledge but also the development of problem-solving, analytical, and adaptive skills that are essential for their future careers – Future Skills. Unlike the other two case studies the computer science course primarily functions as an entry-level format designed to establish a baseline for further competence development at the beginning of students' studies, because in IT-affine study programmes, more advanced competences are already further developed within the traditional curricula.

Research question 3 focused on pedagogical design principles and learning environments that support sustainable competence development across the three domains. Across the case studies several converging insights and key learnings emerged:

1. **Modular design and flexibility**: All three approaches employ modular structures that allow huge flexibility and adaptability to different disciplines, structures and institutions of higher education, the phase within the student live cycle they take place as well as the needs and requirements of the lecturers and supervisors. This approach proved effective in all three case studies as it strongly supports learner autonomy and enables implementation in diverse learning contexts.
2. **Reflection as a core element of competence development**: The case study implementations are grounded and accompanied by a pronounced student reflection process which is designed to be an integral part of the competence development process. This requires learning designs that offer favourable learning environments for the skill development such as peer feedback, formative feedback, and real-life experiences and situated learning. And the evaluations showed clearly that these attempts were strongly acknowledged by the participants.
3. **Importance of guidance and supervision**: The approaches used within the case studies prove most effective when supported by counselling and/or supervision.
4. **Pedagogical embedding**: A successful implementation of formats, as described in the case studies, requires appropriate pedagogical embedding that takes differences in students' prior knowledge and self-regulation abilities into account. In particular, forms of self-directed learning should complement, not replace, guided instruction.

5. **Continuous evaluation and development**: To ensure sustainability and relevance, continuous updates and empirical evaluations of the case studies are required: learning outcomes, transfer into study practices and long-term literacy development.

Nevertheless, the presented case studies show as well some divergences: The possible range of didactic implications of self-directed learning formats range from purely online self-learning elements to (supervised and unsupervised) blended-learning to full-time face-to-face courses. In addition, they are offered for different durations (one week, one term or several years) and timing within the student life cycle (study entry phase, first year of study, last two years). However, these differences do not weaken the overall approach; rather they demonstrate the flexibility of competence-oriented learning designs. And even though all case studies were implemented at a single university, most elements are designed in a way that allows relatively straightforward adaptation and transfer to other higher education institutions.

Importantly, these divergences also reveal potential for cross-case development. For example, the self-learning approach of the course on digital literacy may benefit from additional supervision and closer collaboration with dual partners, drawing on experiences from the Future Skills case study. In addition, the Future Skills and digital literacy might profit from the idea to start with the basic competence development already with freshman students similar to the computer science preparatory course. Further opportunities exist in the area of evaluation: the online-course for digital literacy could incorporate additional quantitative and qualitative assessment methods successfully used in the other two case studies. And finally, the other two case studies may benefit from the implementation of a pre-/post-test design similar to those applied in the computer science context.

Common limitations across the three case studies are: (1) The limited availability of data, both qualitative and quantitative due to small sample sizes. (2) Due to the interrelation of different types of competences (process-related, content-related, …), it is difficult to say which certain combinations thereof are considered particularly relevant. (3) The interventions took place at a single work-integrated university.

These limitations may be addressed through Future research that includes longitudinal data collection, structured evaluation procedures, and comparative analyses in order to empirically substantiate statements on learning effectiveness and the development of subject-specific and interdisciplinary skills ((1) and (2)). This research should also take place at other institutions of higher education (3).

Transferability to other study contexts must be critically discussed, especially in cases with no close contact to industry partners. Empirical testing in other contexts is needed.

6.2 Outlook and future research

The case studies presented in this paper are still in place and used on a regular basis. In line with the DBR approach they are continuously evaluated, adapted and improved. For example, the **Future Skills** programme is implemented in different adapted scenarios. This allows the project team to systematically investigate which learning settings, tools and scenarios most effectively support students in developing Future Skills – and which approaches prove less successful. To support this process, a multi-step evaluation process is being implemented with links to DBR approach, involving educators, students, and participating study coordinators in quantitative and mostly qualitative evaluation processes. This iterative evaluation aims to identify barriers, enabling conditions, and opportunities for further refinement and development. Ultimately, the goal is to develop a theory- and evidence-based blueprint for Future Skills learning in dual study programmes. In addition, the agile adaptation of the originally planned outline in the unfolding study year represents an interesting subject for further research. While the resources and tools have been developed and adapted to a dual higher education context, the resources can be adapted to other higher education and learning contexts as well - provided there is room for experiences and continuous reflection of theory, practice and competence development.

For the **digital literacy** case study, further validation of the competence development remains an important research objective. First, future research could examine the interactions between students' and teachers' digital literacy and the implications of these dynamics for teaching and

CC BY NC

learning processes. Second, as part of the Future Skills set there is the need for ongoing adaptation to emerging technologies and epistemic challenges. Third, it remains to be explored to what extent pedagogical elements – such as supervision and the systematic use of ePortfolios – can be integrated into the learning design to further support reflective competence development.

The computer science preparatory course is continuously improved based on feedback from participants and instructors. In addition to expanding the range of materials for potential project implementations, the learning materials - such as the scope of differentiated assignments - are also being further developed. Currently, a diagnostic instrument in the form of a pre- and post-test is being developed for the funding initiative, covering the areas of “Algorithms”, “Programming”, “Logic” and “Overview: Computer Science”. Within the preparatory course, it is intended to assess existing computer science knowledge before and after the course. This testing procedure is currently in the piloting phase.

As already mentioned, concerning the use and adaptation of the cases for other institutions of higher education the case studies offer a huge **transfer potential**. The case studies on digital literacy and key computer science competences do not rely on the work-integrated nature of our university. So, the findings may be transferred rather easily to other institutions of higher education. Concerning the case study on Future Skills the given flexibility allows most aspects to transfer, but for all aspects with dual partners’ involvement a possible transfer and necessary modifications must be evaluated more thoroughly by evaluating the case studies at other institutions of higher education.

Statement

The peer-review process and editorial decision were handled independently by members of the Editorial Board who were not involved as authors. The authors took no part in the review or decision-making process.

References

Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). *GreenComp: The European sustainability competence framework* (Y. Punie & M. Bacigalupo, Eds.; EUR 30955 EN; JRC128040). Publications Office of the European Union. https://doi.org/10.2760/13286

Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), 5–8.

Ehlers, U.-D. (2020*). Future Skills: Lernen der Zukunft – Hochschule der Zukunft [Future Skills: Learning of the future – University of the future].* Springer https://doi.org/10.1007/978-3-658-29297-3

Fallböhmer-Koob, A. (Ed.) (2024). *Kreidezeit?! Kompetenzentwicklung an Hochschulen für das 21. Jahrhundert*. University of Applied Science Kaiserslautern. [Kreidezeit?! Competence Development at Higher Education Institutions for the 21st Century. Kaiserslautern University of Applied Sciences.] https://doi.org/10.57997/3h83-hr89

García-Álvarez, J., Vázquez-Rodríguez, A., Quiroga-Carrillo, A., & Priegue Caamaño, D. (2022). Transversal competences for employability in university graduates: A systematic review from the employers’ perspective. *Education Sciences*, 12(3), 204. https://doi.org/10.3390/educsci12030204

Hattermann, M., Salle, A., Schumacher, S., & Heinrich, D. C. (2021). Zusammenfassung der Ergebnisse und Transfermöglichkeiten in die Hochschulpraxis. In*: Mathematiklernen mit Digitalen Medien an der Hochschule: Konzepte, Umsetzungen und Ergebnisse aus dem Projekt Mamdim* (S. 289–293) [Summary of results and possibilities for transfer to higher education practice. In: Learning Mathematics with Digital Media in Higher Education: Concepts, Implementations, and Results from the Mamdim Project (pp. 289–293)] Springer Fachmedien Wiesbaden GmbH.

Hellmig, L., Burk, S., Greubel, A., Hennecke, M., Herper, H., Hilbig, A., Michaeli, T., Mittag, A., Pasternak, A., Puhlmann, H., Röhner, G., Rücker, M., Schmalfeldt, T., Spalteholz, W., & Stechert, P. (2024). *Empfehlungen der Gesellschaft für Informatik e.V.: Bildungsstandards Informatik für die Sekundarstufe I [Recommendations of the German Informatics Society (GI): Educational Standards in Informatics for Lower Secondary Education]*. https://informatikstandards.de/fileadmin/FA/IBS/user_upload/Bildungsstandards_Sek_I_2025__pdf-A_.pdf

Holdener, A., Bellanger, S., & Mohr, S. (2018). *„Digitale Kompetenz“ als hochschulweiter Bezugsrahmen in einem Strategieentwicklungsprozess*. ["Digital literacy" as a university-wide frame of reference in a strategy development process.] https://doi.org/10.25656/01:15780

Kämper, S. (2003). Algorithmenentwurf. In: S. Kämper (Hrsg.), *Grundkurs Programmieren mit Visual Basic: Die Grundlagen der Programmierung—Einfach, verständlich und mit leicht nachvollziehbaren Beispielen* (S. 1–21). [Basic Course in Programming with Visual Basic: The Fundamentals of Programming—Simple, clear, and with easy-to-follow examples (pp. 1–21)] Vieweg+Teubner Verlag. https://doi.org/10.1007/978-3-322-92940-2_1

Kirchherr, J., Klier, J., Lehmann-Brauns, C., & Winde, M. (2018). *Future Skills: Welche Kompetenzen in Deutschland fehlen. [Future Skills: Which Competencies Are Lacking in Germany] 11*.

Klier, J., Winde, M., Projektteam Stifterverband, & Projektteam McKinsey Company. (2021). *Future Skills 2021—21 Kompetenzen für eine Welt im Wandel. [Future Skills 2021—21 Competencies for a Changing World.]* https://www.stifterverband.org/medien/future-skills-2021

Kolb, D. A. (1984). *Experimental learning: Experience as the source of learning and development*. Prentice-Hall.

Koubek, J. (2005). Informatische Allgemeinbildung. In: S. Friedrich & Gesellschaft für Informatik (Hrsg.), *Unterrichtskonzepte für informatische Bildung* (S. 57–66). Ges. für Informatik. [General Informatics Education. In S. Friedrich & German Informatics Society (Eds.), Teaching Concepts for Informatics Education (pp. 57–66). German Informatics Society.]

Kovalcik, B. (2019). Developing employability skill articulation in college students: A framework and practitioner approaches for co-curricular educators. *Journal of Campus Activities Practice and Scholarship*, 1(2), 26–31. https://doi.org/10.52499/2019013

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1975). Taxonomie von Lernzielen im affektiven Bereich (H. Dreesmann, Trans.*). Beltz-Studienbuch*: Vol. 85. Beltz.

Krempkow, R. (2021). Wie digital kompetent sind Studierende? Ein Konzept und Erhebungsinstrument zur Erfassung digitaler und fächerübergreifender Kompetenzen. *Qualität in der Wissenschaft*, 22–29. [How digitally competent are students? A concept and assessment tool for measuring digital and cross-disciplinary competencies. Qualität in der Wissenschaft, 22–29.]

Mandl, H., & Krause, U. M. (2001). *Lernkompetenz für die Wissensgesellschaft*. München: Ludwig-Maximilians-Universität

Mayring, P. (2022). *Qualitative Inhaltsanalyse: Grundlagen und Techniken* (13., überarbeitete Auflage). [Learning Competence for the Knowledge Society. Munich: Ludwig Maximilian University

Mayring, P. (2022). Qualitative Content Analysis: Foundations and Techniques (13th, revised edition).] Beltz. https://www.content-select.com/index.php?id=bib_view&ean=9783407258991

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Ministerium für Kultus, Jugend und Sport (Ed.). (2023).

Bildungsplan 2016: *Naturwissenschaft und Technik (NwT): Basisfach in der Kursstufe*. [2016 Curriculum: Natural Sciences and Technology: Basic Subject in the Upper Secondary Phase] https://informatikstandards.de/fileadmin/FA/IBS/user_upload/Bildungsstandards_Sek_I_2025__pdf-A_.pdf

Ministerium für Kultus, Jugend und Sport Baden-Württemberg (Ed.). (2018a). *Bildungsplan 2016: Aufbaukurs Informatik*.[Ministry of Education, Youth and Sports Baden-Württemberg (Ed.). (2018a). Curriculum:2016: Advanced Computer Science Course.] https://bildungsplaene-bw.de/site/bildungsplan/get/documents/lsbw/export-pdf/depot-pdf/ALLG/BP2016BW_ALLG_SEK1_INF7.pdf

Ministerium für Kultus, Jugend und Sport Baden-Württemberg (Ed.). (2018b). *Bildungsplan 2016: Informatik, Mathematik, Physik (IMP): Profilfach*. [Ministry of Education, Youth and Sports Baden-Württemberg (Ed.). (2018b). Curriculum 2016: Computer Science, Mathematics, Physics (IMP): Profile Subject.] https://www.bildungsplaene-bw.de/,Lde/BP2016BW_ALLG_GYM_IMP

Mordhorst, L., & Jenert, T. (2023). Curricular integration of academic and vocational education: A theory-based empirical typology of dual study programmes in Germany. *Higher Education*, 85, 1257–1279. https://doi.org/10.1007/s10734-022-00889-7

OECD. (2019). OECD Learning Compass 2030: A series of concept notes. OECD.

Petri, P. S., Krempkow, R., Ebner, M., & Getto, B. (2024). Editorial: Digitale Kompetenzen—Zur Rolle dieser „Future Skills“ im Hochschulkontext: Definition und Bedeutsamkeit, Messung und Förderung. *Zeitschrift für Hochschulentwicklung*, 19(1). [Editorial: Digital Literacy—On the Role of these “Future Skills” in the Higher Education Context: Definition and Significance, Measurement and Fostering. Journal for Higher Education Development, 19(1)] https://doi.org/10.21240/zfhe/19-01/01

Röhner, G., Brinda, T., Denke, V., Hellmig, L., Heußer, T., Pasternak, A., Schwill, A., & Seiffert, M. (2016). *Bildungsstandards Informatik für die Sekundarstufe II: Empfehlungen der Gesellschaft für Informatik e. V.* [Educational Standards in Computer Science for Upper Secondary Education: Recommendations of the German Informatics Society.] https://informatikstandards.de/fileadmin/GI/Projekte/Informatikstandards/Dokumente/Bildungsstandards_SII.pdf

Schnirch, A., Ridinger, N., & Weschenfelder, F. (2020). *Raspberry Pi im Informatik- und Technikunterricht: Konzeption eines handlungs- und problemorientierten Unterrichts mit der MicroBerry-Lernumgebung*. Springer Fachmedien. [Raspberry Pi in Computer Science and Technology Education: Designing Action- and Problem-Oriented Lessons Using the MicroBerry Learning Environment. Springer Fachmedien] https://doi.org/10.1007/978-3-658-28793-1

Schön, D. A. (1983). *The reflective practitioner: how professionals think in action*. Basic Books.

Schröter, P., Groß, A., Schmid-Kühn, S. M., Stanat, P., & Hoffmann, L. (2022). Das unvergleichliche Abitur. wbv Publikation. [The Incomparable University entrance exam. wbv Publication] https://doi.org/10.3278/9783763972494

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, 55(1), 5–14

Stake, R. E. (1995). *The art of case study research*. SAGE.

Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), 5–23.

Weinert, F. E. (2001). Concept of competence: A conceptual clarification. In D. S. Rychen & L. H. Salganik (Eds.), *Defining and selecting key competences* (pp. 45–65). Göttingen: Hogrefe & Huber.

Yan, Z., & Boud, D. (2022). Conceptualising assessment-as-learning. In Z. Yan & L. Yang (Eds.), Asia-Europe education dialogue. *Assessment as learning: Maximising opportunities for student learning and achievement* (pp. 11–24). Routledge Taylor & Francis Group

Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Thousand Oaks, CA: Sage

European Scientific Journal for Dual Higher Education

Vol. 2, No. 2 (2026)
ISSN (online): 3052-7015

A STUDY OF STAKEHOLDER PERSPECTIVES ON ESTABLISHED CHARACTERISTICS AND AREAS FOR DEVELOPMENT IN A COOPERATIVE STATE UNIVERSITY IN GERMANY

Ernst Deuer [1] *and Julian Fritsch* [1*]

[1] *Baden-Wuerttemberg Cooperative State University (DHBW) and Institute for Higher Education and Educational Research (IHB) of the Baden-Wuerttemberg Cooperative State University (DHBW), Germany*

Keywords:
Higher education
Theory
Practice
Vocational
Artificial intelligence

Article history:
Received: 28 January 2026
Revised: 1 April 2026
Accepted: 14 April 2026

To cite this article:
Deuer, E. & Fritsch, J. (2026). A Study of Stakeholder Perspectives on Established Characteristics and Areas for Development in a Cooperative State University in Germany. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), 37-52. https://doi.org/10.82321/07MA-34M64

Abstract
Cooperative state universities have become an integral part of the German higher education system. Ongoing social, technological, and labour market changes, however, require continuous development of structures, curricula, and institutional conditions. This study evaluates (a) the relevance of established characteristics and (b) potential areas for development using a multilateral perspective. An online survey was distributed to all stakeholders of the Baden-Wuerttemberg Cooperative State University, yielding responses from 2,401 students, 184 professors, 1,504 external lecturers, and 1,118 dual partners. Results indicate that most established characteristics were considered relevant, with the highest approval for alternating theory-practice phases and the lowest for intensive study programmes. Regarding areas of development, stakeholders identified potential for adapting the programme design to developments in artificial intelligence, strengthening the theory-practice linkage, ensuring non-discriminatory access, or fostering life skills. Compared to other groups, professors expressed the lowest approval rates for these development areas. Overall, the findings suggest that the current system requires fine-tuning of existing elements rather than a fundamental structural transformation.

1 Introduction

The establishment of Professional Academies (Berufsakademien) in the German federal state Baden-Wuerttemberg more than fifty years ago transferred the principle of dual vocational training to the tertiary sector. Characteristic features of this concept include, among others, (a) contractual relationships between companies or social institutions (i.e., dual partners) and students, (b) curricula that specify workplace-based course content, and (c) typically parity-based representation of the institutions involved in relevant governance bodies (Deuer & Träger, 2015).

The success of this new educational model is reflected in the rapid growth of new locations first within the federal state of Baden-Wuerttemberg itself and subsequently throughout Germany. Moreover, the German Council of Science and Humanities (Wissenschaftsrat) has repeatedly

* Corresponding author
E-mail address: julian.fritsch@dhbw-karlsruhe.de

acknowledged its important role in the German education system. Specifically, this new educational model has been recognised as offering a promising means to further diversify the German higher education system (Wissenschaftsrat, 1993). It has been emphasised that, although its profile differs from that of universities of applied sciences, the education provided may be considered equivalent in terms of overall professional qualification (Wissenschaftsrat, 1994). A specific indicator of the success is that, in evaluations of newly established professional academies in other German federal states, the system in Baden-Wuerttemberg was used as a benchmark (Wissenschaftsrat, 1996; Wissenschaftsrat, 2004).

The transition from the Professional Academies Baden-Wuerttemberg to the Baden-Wuerttemberg Cooperative State University (Duale Hochschule Baden-Wuerttemberg) was another milestone. This transition entailed full equality of status under higher education law compared with other types of higher education institutions. This status further increased the relevance of dual education programmes and sustainably consolidated their position within the German higher education system. Today, dual programmes are also offered by universities of applied sciences and some universities. Moreover, the disciplinary range has expanded beyond business, engineering and social work to fields such as health and nursing (e.g., Jürgensen et al., 2023). Although smaller in quantitative terms than other types of higher education institutions, the more than 140,000 students (about 5%) enrolled in dual education programmes in the winter term 2023/24 demonstrate that the dual education system has established itself as an integral part of the German higher education landscape (Centrum für Hochschulbildung, 2024).

Considering the ongoing social, technological, and labour market changes, cooperative state universities, like all higher education institutions, face the challenge of continuously developing their structures, curricula, and institutional conditions (Loorbach & Wittmayer, 2024). These challenges include the diversification of student populations, increasing international competition, or a growing emphasis on quality assurance and outcome-oriented governance (Hazelkorn, 2015). Moreover, digital disruption is reshaping teaching, learning, and work processes (Scholkmann et al., 2024). In this context, dual education programmes must be designed to attract both students and partner companies. For students, they should provide a high-quality, future-oriented pathway with clear prospects for development and employment. For companies, they represent a promising instrument for recruiting and retaining skilled workers. The long-term sustainability of dual study programmes therefore depends on the extent to which they succeed in integrating the interests and expectations of both sides into a balanced educational system.

Against this backdrop, the present study pursues two main objectives. First, it examines how established characteristics of cooperative state universities are perceived as relevant by different stakeholders (i.e., students, professors, external lecturers, and dual partners). Surveying different stakeholder groups may provide richer information than the predominant single-stakeholder approaches in existing research, which often focus, for example, solely on students' perspectives (e.g., Luekitinan, 2018). While research often focuses on specific aspects of dual education, this study focuses on both the relevance of organisational features (e.g., the regular change between theoretical and practical phases) and teaching or practice-oriented elements (e.g., practice-oriented examination formats). This evaluation can provide a solid basis for cooperative state universities to effectively address ongoing social, technological, and labour market changes (Loorbach & Wittmayer, 2024). By understanding to what extent these characteristics are still valued, institutions can better adapt their structures, curricula, and institutional frameworks to align with the evolving needs and expectations of the different stakeholders (de Groot et al., 2025). Second, the study further explored the relevance of potential areas for development in four domains of cooperative state universities that are highly relevant in higher education systems: (1) programme design, (2) practice- and research-orientation, (3) equality of opportunity and study access, and (4) sustainability, internationalisation, and personality development. This aim responds to the need for higher education institutions to continuously develop and adapt to societal change (Loorbach & Wittmayer, 2024).

2 Methodology

2.1 Procedure

An online survey was sent to all relevant stakeholders associated with the Baden-Wuerttemberg Cooperative State University in the summer term 2025. The stakeholders included students, professors, external lecturers, and dual partners. Of the 30,685 students contacted, 2,401 (7.82%) completed the survey. Of the 901 professors contacted, 184 (20.42%) completed the survey. Of the 6,732 external lecturers contacted, 1,504 (22.34%) completed the survey. Of the 5,861 dual partners contacted, 1,118 (19.08%) completed the survey.

2.2 Survey

The survey comprised several sections addressing established characteristics of cooperative state universities as well as potential areas for development.

2.2.1 Established characteristics of cooperative state universities

Regarding established characteristics, the survey addressed organisational and teaching/ practice-related topics. For both topics, three questions were asked, in which the participants were asked to rate the relevance for each characteristic on a 7-point Likert scale from 1 (very unimportant) to 7 (very important). There was no possibility to add free comments in the survey.

The questions about organisational aspects addressed (1) the regular change between theory-phases and practice-phases, (2) the feasibility of completing within the standard period of study, and (3) the intensive study programme with 210 ECTS credits in six semesters. The questions about teaching/practice-related aspects addressed (1) the small-group teaching approach in the theory phases, (2) the high proportion of lecturers from professional practice, and (3) practice-oriented examination formats.

2.2.2 Areas for development

Regarding areas for development, four domains were included: (a) programme design, (b) practice- and research-orientation, (c) equality of opportunity and study success, and (d) sustainability, internationalisation, and personality development. For each domain, four aspects were addressed. The participants were again asked to rate the relevance for each characteristic on a 7-point Likert scale from 1 (very unimportant) to 7 (very important). Again, the survey did not include open-ended comment fields.

For the domain of programme design, questions were asked about (1) adaptation of curricula and assessment methods to changes brought about by Artificial Intelligence, (2) development of new hybrid and flexible teaching formats, (3) extension of the curriculum, and (4) promotion of interdisciplinarity in dual study programmes. For the domain of practice- and research-orientation, questions were asked about (1) strengthening the linkage between theory and practice, (2) the practice- and labour-market-oriented design of study programmes, (3) strengthening research activities, and (4) the promotion of an entrepreneurial culture in dual study programmes. For the domain of equality of opportunity and study success, questions were asked about (1) ensuring equal and non-discriminatory access to higher education, (2) the promotion of women and the strengthening of gender equality, (3) the promotion of inclusion, and (4) the reduction of student dropout rate. For the domain of sustainability, internationalisation, and personality development, questions were asked about (1) promotion of sustainability and climate protection at the university, (2) the promotion of mental health and well-being among students, (3) the development of personal and social competencies (life skills), and (4) advancing the internationalisation of academic studies.

CC BY NC

2.3 Statistical analysis

For the analyses, responses were dichotomised by comparing respondents who rated an item above the midpoint of the scale (values 5–7) with those who rated it at or below the midpoint (values 1–4). We deliberately chose this procedure for two main reasons. First, our research questions focus on whether stakeholders regard an aspect as at least somewhat important rather than neutral or unimportant. Distinguishing clearly between "(rather) important" and "not (rather) important" may be relevant for decision-making, where management and policy actors typically need to know which aspects reach a clear threshold of perceived importance across stakeholder groups. Second, more practically, the dichotomisation facilitates communication of results to non-academic audiences (e.g., dual partners) by allowing the use of easily interpretable percentages (e.g., "X% of students consider this aspect (rather) important") and straightforward group comparisons.

3 Results and discussion

First, the results regarding the established characteristics of cooperative universities including the two subsections on organisational characteristics and teaching/practice-related topics are shown and discussed. Subsequently, the results on areas for development with the four domains programme design, practice- and research-orientation, equality of opportunity and study success, and sustainability, internationalisation, and personality development are presented and discussed.

3.1 Established characteristics of cooperative state universities

3.1.1 Organisational characteristics

The percentages of agreement for all three topics across the different stakeholders are shown in Figure 1.

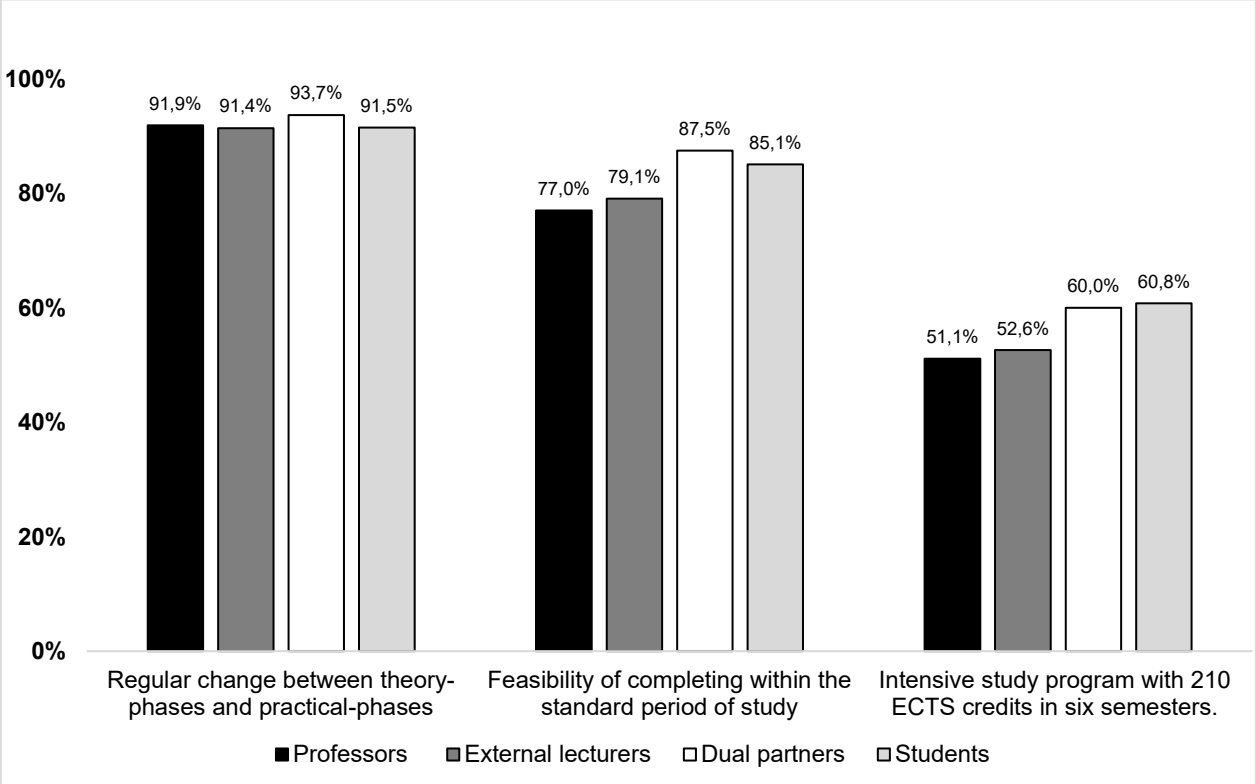

Figure 1. Relevance of organisational characteristics

Stakeholders acknowledge the regular change between theory and practical phases with agreement rates above 90% in all groups. This result shows a broad consensus across the groups and is consistent with the idea that this regular change is the essence of cooperative state universities (Gerstung-Jungherr & Deuer 2025a). It enables the integration of scientifically grounded knowledge and professional application, as theoretical content can be promptly tested in practice. Practical experiences can, in turn, be reflected upon during the theoretical phases. This characteristic is not only a key attraction of dual study programmes (Deuer, 2017), but also marks their distinction from other study formats.

The vast majority also agreed that it should be feasible to complete the studies within the standard period of study. This characteristic entails that a well-structured study programme that can be completed within a defined period provides reliability and enables efficient planning both for students and for the cooperating companies. Because students (85.1%) and cooperating companies (87.5%) are more directly affected by this, it can also explain the slightly lower ratings given by professors (77.0%) and external lecturers (79.1%).

Compared to the other two characteristics, the agreement for the relevance of an intensive study programme with 210 ECTS credits in six semesters was considerably lower (between 51.1% and 60.8%). This characteristic offers students formal advantages, for example with regard to access to master's programmes. For the dual partners, the concise and structured duration of study may allow a large amount of knowledge to be conveyed within a short period of time. At the same time, however, it is associated with a high workload within a comparatively short period of time and thus places high demands on students. The comparatively low rating of its relevance gives rise to several possible interpretations. It is conceivable that the formal advantages of the intensive study programme are not fully known to all stakeholders or play only a subordinate role in everyday study life. Moreover, the intensive study programme may primarily be perceived as an additional source of stress and strain (Olson et al., 2025).

3.1.2 Teaching/practice-related topics

The percentages of agreement for all three topics across the different stakeholders are shown in Figure 2.

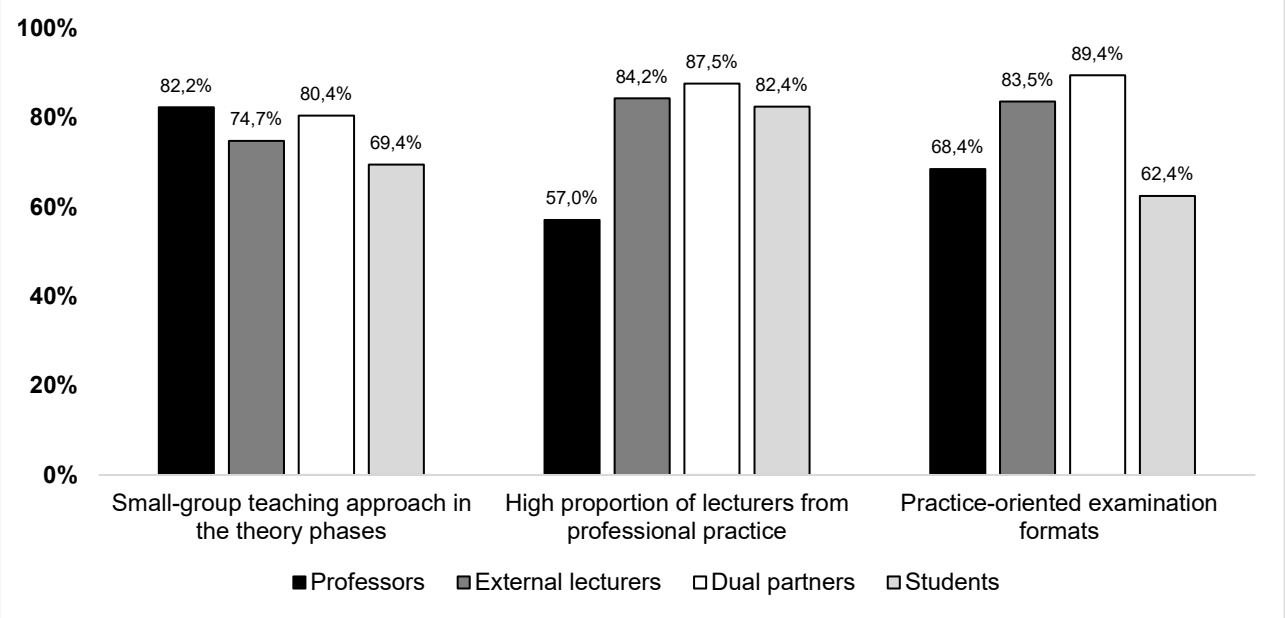

Figure 2. Relevance of teaching/practice-related characteristics

The small-group teaching approach in the theory phases is particularly valued by professors (82.2%) and dual partners (80.4%), while the agreement rates are slightly lower for students (69.4%)

and external lecturers (74.7%). Small groups allow intensive supervision and promote the continuous exchange between lecturers and students. Due to the small size of the groups, instructional content can be more rigorously oriented towards concrete practical examples, while individual professional experiences are systematically incorporated into the teaching sessions. This teaching method not only facilitates individualised learning, but also fosters a high degree of interactivity, which in turn enhances the sustainable transfer between theoretical knowledge and practical application (Silseth & Furberg, 2024). Students may not directly perceive the advantages of small groups or may already regard the existing group sizes (typically up to 30 participants per course) as relatively large. It is possible that comparisons with traditional lectures at universities remain abstract for many students because they often lack personal experience with large lecture halls and anonymous teaching environments as a reference point.

Students, dual partners, and external lecturers view the high proportion of lecturers from professional practice as highly important with agreement rates between 82.4% and 87.5%. Lecturers from professional practice can provide current specialist knowledge, real-world problem scenarios, and valuable professional experience to teaching, thereby making an important contribution to the strong applied orientation of dual study programmes. Particularly in highly dynamic and practice-oriented fields (e.g., artificial intelligence), they may possess up-to-date expertise that meaningfully complements and enriches the scientifically grounded teaching process (Deuer, 2019). The agreement rate of 57.0% is considerably lower among professors. This discrepancy points to differing perspectives and role conceptions among the stakeholders involved. While external lecturers understandably assess their own contribution as particularly relevant, and dual partners primarily expect a strong practical orientation in teaching, students benefit directly from realistic impulses and current practice examples. In contrast, professors are more likely to evaluate the involvement of external teaching staff in a more nuanced manner. In addition to didactic quality, curricular integration, and the long-term safeguarding of academic standards, implicit role demarcation may also play a part (Taylorson et al., 2025). For instance, when external practical expertise is perceived not merely as a complement but at times as a potential competitor to one's own disciplinary authority.

Regarding practice-oriented examination formats, both dual partners (89.4%) and external lecturers (83.4%) view them as highly relevant, while the agreement rates are lower for students (62.4%) and professors (68.4%). The high agreement rates for dual partners and external lecturers can be attributed to the fact that practice-oriented examination formats promote the application of theoretical knowledge in real or realistically simulated professional situations. Thus, they make an important contribution to strengthening problem-solving competencies (de la Fuente et al., 2023). Project work plays a central role in this regard, in which students address specific issues from their organisational environment, apply theoretical concepts, and systematically reflect on the results. In this way, project works combine scientific requirements with practical relevance and renders the application-oriented character of dual study programmes directly visible in performance assessment. In contrast, students may perceive traditional examination formats as advantageous with regard to predictability, transparency, and equality (Fink et al., 2025). These formats provide comparable conditions and assessment criteria, whereas individual practice-based projects are often experienced as difficult to compare due to the highly diverse organisational contexts, available resources, and varying levels of support from training staff. In contrast, traditional examinations may appear to students as less dependent on organisational factors. From the perspective of professors, increased supervisory and assessment effort, as well as the limited comparability of examination performance, may influence their perception.

3.2 Areas for development

3.2.1 Programme design

The percentages of agreement for all four domains across the different stakeholders are shown in Figure 3.

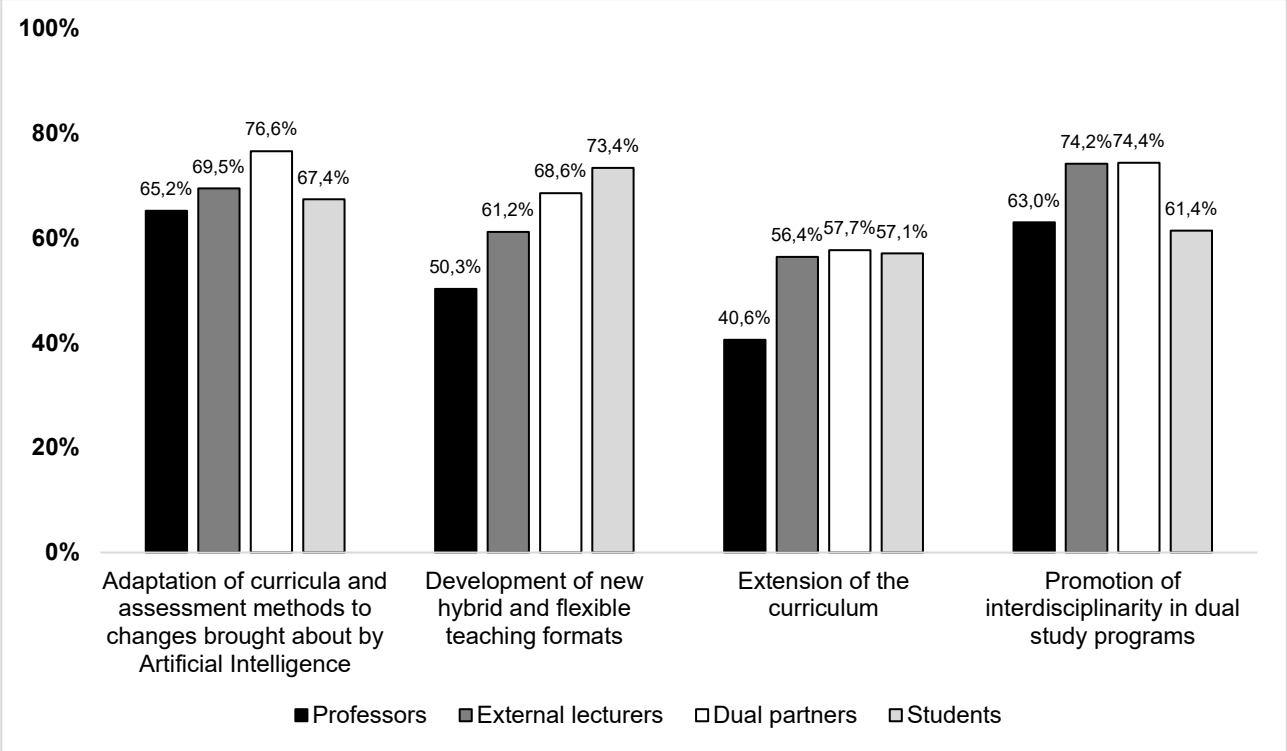

Figure 3. Programme design

Generally, all stakeholders view it as important to adapt curricula and assessment methods to changes brought about by artificial intelligence. The agreement rate is highest for dual partners (76.6%) compared to the other three groups (between 65.2% and 69.5%). The comparatively high level of approval among dual partners underscores its labour market and practice-oriented relevance. It points to a growing expectation that artificial-intelligence-related competencies should be addressed not merely selectively, but systematically and embedded within the curriculum of dual study programmes (Long et al., 2025). These adaptations may pertain both to course content and to didactic and assessment methods (Gerstung-Jungherr & Deuer, 2025b). At the curricular level, this implies, for example, a stronger integration of Artificial Intelligence-related foundations, fields of application, and ethical issues into existing modules. Moreover, it can refer to the development of independent courses on data analysis, algorithmic thinking, or the reflective use of Artificial Intelligence tools in professional contexts. At the same time, the increasing use of Artificial Intelligence-supported tools necessitates an adaptation of examination formats, such as more project- and competence-oriented assessments, open task formats, reflexive components, or the targeted inclusion of Artificial Intelligence as an approved working instrument.

The agreement rates regarding the development of new hybrid and flexible teaching formats vary considerably between the different stakeholders. While agreement among professors is lowest, at 50.3%, students have the highest agreement rate with 73.4%. This distribution points to different interests across the groups. Students may particularly benefit from temporal and spatial flexibility, which facilitates the reconciliation of study requirements with practical phases and private commitments (Deuer, 2021). For external lecturers, who are often not permanently present at the university location, hybrid formats also constitute a pragmatic prerequisite for their teaching activities. For dual partners, greater flexibility in teaching can also be advantageous because it simplifies the coordination between organisational deployment phases and academic learning. By contrast, the comparatively lower agreement rate among professors suggests that traditional face-to-face formats continue to be regarded as particularly effective didactically, or that hybrid teaching formats are associated with increased administrative efforts (see also Hettler et al. 2021).

The agreement rates for an extension of the curriculum are relatively low between 40.6% among professors and 57.7% among dual partners. The overall moderate approval ratings suggest

that the current range of subjects is generally perceived as appropriate, while additions are considered helpful. The comparatively lower level of approval among the professors can be partly explained by the fact that professorships are typically appointed for clearly defined subject areas, structurally limiting the scope for substantive extension.

The promotion of interdisciplinarity in dual study programmes is valued slightly more highly by dual partners (74.4%) and external lecturers (74.2%) than by students (61.4%) and professors (63.0%). Overall, this result points to broad support for cross-disciplinary approaches within dual study programmes. The high level of approval among dual partners and lecturers underscores the importance of interdisciplinary competencies for addressing complex professional demands (Vladova et al., 2025). This primarily involves the targeted linkage of traditional academic disciplines with adjacent fields. In this context, new study programmes may emerge or existing ones may be further developed, for example through interdisciplinary project work or cross-programme courses.

3.2.2 Practice- and research-orientation

The percentages of agreement for all four domains across the different stakeholders are shown in Figure 4.

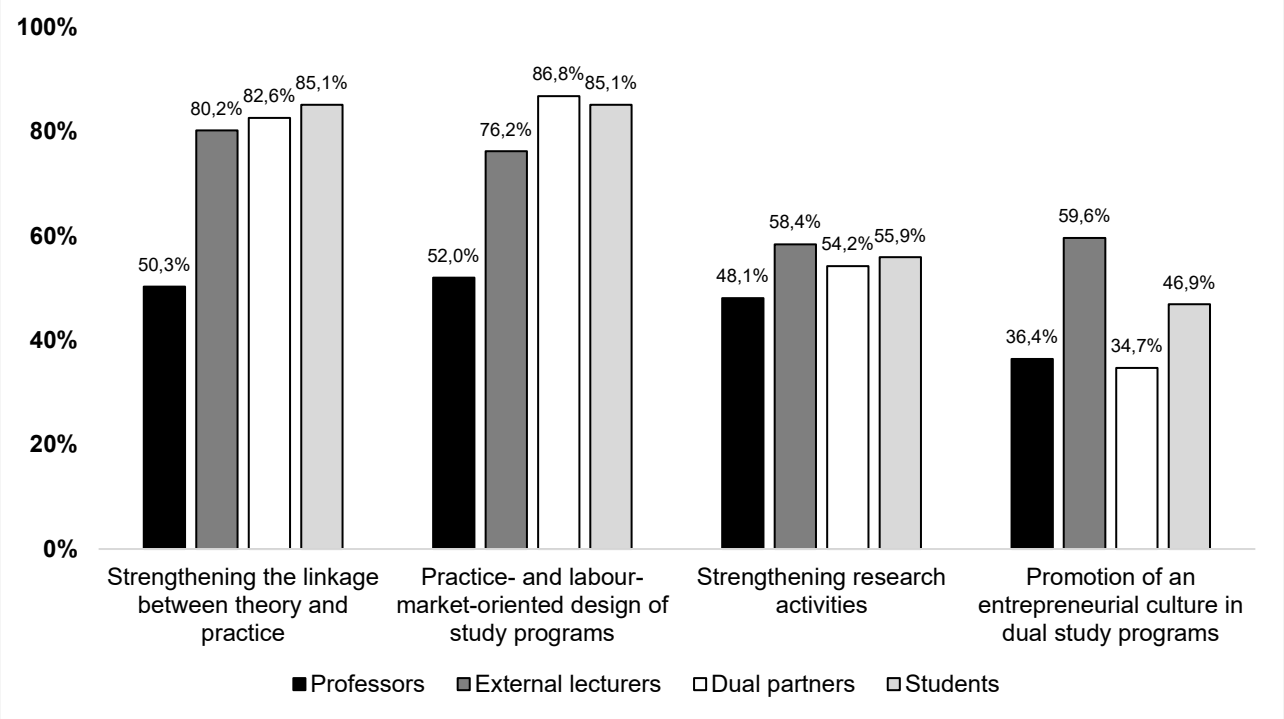

Figure 4. Practice- and research-orientation

Students, external lecturers, and dual partners clearly support the idea of strengthening the linkage between theory and practice (agreement rates between 80.2% and 85.1%). The linkage between theory and practice is viewed as the essence of dual education systems (Gerstung-Jungherr & Deuer, 2025a). A central question typically concerns how practical phases within organisations and academic course content can be more closely aligned, so that they complement one another and enable a sustainable, labour-market-relevant development of competencies (Deuer, Miez-Mangold & Thieme 2024). The lower agreement rate of the professors (50.3%) indicates that a considerable proportion of professors already regard the status quo as sufficient or perceive limits to further strengthening the linkage.

Students (85.1%), dual partners (86.8%), and slightly less external lecturers (76.2%) view a more practice- and labour-market-oriented design of study programmes as highly important. The agreement rate of the professors is again considerably lower with 52.0%. Overall, this reveals a clear

expectation among three of the four stakeholder groups that study programmes should be more strongly oriented toward current and future labour market requirements. The comparatively lower approval rate among professors points to distinct assessments of the status quo as well as potential conflicts between scientific standards and immediate labour market orientation.

Approval rates for the strengthening of research activities are generally moderate, ranging from 48.1% among professors to 58.4% among external lecturers. An explicit research mandate came with the transformation from Professional Academies to Cooperative State Universities in Germany. Since then, practice-oriented and transfer-focused research formats have emerged, often closely linked to dual partners. In addition to practice-related research projects, this also includes the integration of current practical issues into student projects and theses. Furthermore, new approaches have been developed in order to enable research-based learning (Kolano et al., 2023). The comparatively moderate approval among professors may indicate that existing research activities are already regarded as sufficient. Moreover, structural conditions such as limited time resources, teaching obligations, or the absence of research infrastructure may be perceived as constraining factors for further intensification of research activities.

The highest approval for promoting an entrepreneurial culture in dual study programmes is given by external lectures with 59.6%, while the approval ratings are considerably lower for dual partners (34.7%) and professors (36.4%). The comparatively low level of approval among dual partners may be explained by the fact that most cooperating companies primarily regard dual study programmes as an instrument for recruiting and retaining their own skilled workforce (Deuer, 2022). The more reserved evaluation on the part of the professors may be related to the typical career trajectories of graduates, which are predominantly characterised by dependent employment rather than self-employment. Thus, the promotion of entrepreneurial competencies may be perceived as a complementary, but not as a central profile characteristic of dual study programmes.

3.2.3 Equality of opportunity and study success

The percentages of agreement for all four domains across the different stakeholders are shown in Figure 5.

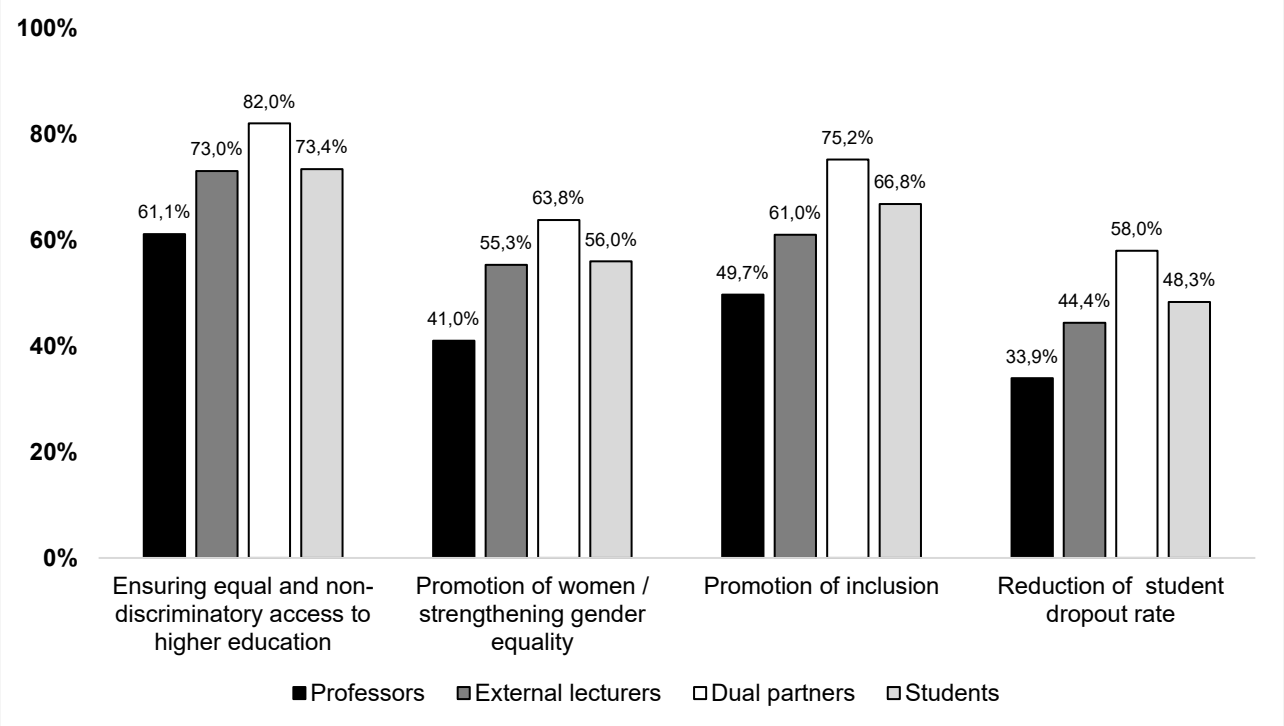

Figure 5. Equality of opportunity and study success

All stakeholder groups generally agree on the relevance of ensuring equal and non-discriminatory access to higher education. The approval is highest for dual partners (82.0%) and lowest for professors (61.1%). Overall, these findings highlight that equity of opportunity is perceived as an important objective of dual study programmes. In fact, dual study programmes have a comparatively high permeability with proportion of students from non-academic family backgrounds than traditional universities (Deuer, 2024). The particularly strong support from dual partners underscores the importance of a diverse and inclusive student representation supporting the long-term safeguarding of skilled labour (for a review of diversity in higher education see Resch, 2023). At the same time, dual partners bear a special responsibility in this regard, as the selection of students lies exclusively within their remit. The enrolment at the university in a dual study programme is only possible if a study contract with a dual partner has already been concluded. Consequently, the recruitment and selection processes of the companies directly determine the extent to which equity of opportunity is actually realised within dual study programmes.

The approval rates for an enhanced promotion of women / strengthening gender equality range between 40.1% among professors to 63.8% among dual partners. The lower approval rate among professors may suggest that existing structures are already perceived as sufficient. Moreover, it may be that issues of gender equality in the context of dual study programmes are not regarded as a specific target. It can also not be ruled out that equality measures are partly associated with concerns that they might stand in tension with principles of performance, claims to excellence, or the idea of selecting the best candidates (Petrova-Stooyanov et al., 2020). Concepts such as “inclusive excellence” (Erbe 2020), which view performance orientation and equity of opportunity not as opposites but as complementary goals, appear in this context to be less established. A more differentiated assessment within the student group - gender was assessed only for this stakeholder group in the survey - reveals pronounced gender-specific differences. While only around two-fifths of male students perceive a need for further action, more than 70% of female students express a demand for development in the area of the promotion of women and gender equality.

Regarding the promotion of inclusion, there is a considerable range between approval rates of 49.7% among professors and 75.2% among dual partners. The high level of approval among dual partners may be due to the fact that they regard inclusion not only as a societal responsibility, but also as a strategic factor for tapping additional potential in the labour market while ensuring the long-term availability of skilled workers. At the same time, inclusive study and working conditions may help prevent student dropouts and safeguard investments already made in training and qualification. Inclusion can encompass various dimensions (Marom & Hardwick, 2025). These include, for example, the removal of barriers for students with physical or psychological impairments, the consideration of diverse social and educational backgrounds, the handling of chronic illnesses or caregiving responsibilities, as well as the creation of study conditions that enable equal participation for international or non-traditional students. In the dual education context, inclusion additionally concerns the coordination between university and company, for instance with regard to flexible deployment models, adapted practical phases, or supportive accompanying structures.

The approval for reducing the student dropout rate ranges from 33.9% among professors to 58.0% among dual partners. From the perspective of dual partners, each student dropout represents a concrete setback for corporate qualification, personnel, and investment planning. By contrast, the comparatively lower level of approval among professors points to a different perspective on student dropouts and acceptable attrition rates (Deuer & Wild 2017). In this context, dropouts may also be interpreted as a result of academic selectivity, problems of fit, or the failure of necessary performance requirements, and thus - at least implicitly - understood as part of a quality assurance process.

3.2.4 Sustainability, internationalisation, and personality development

The percentages of agreement for all four domains across the different stakeholders are shown in Figure 6.

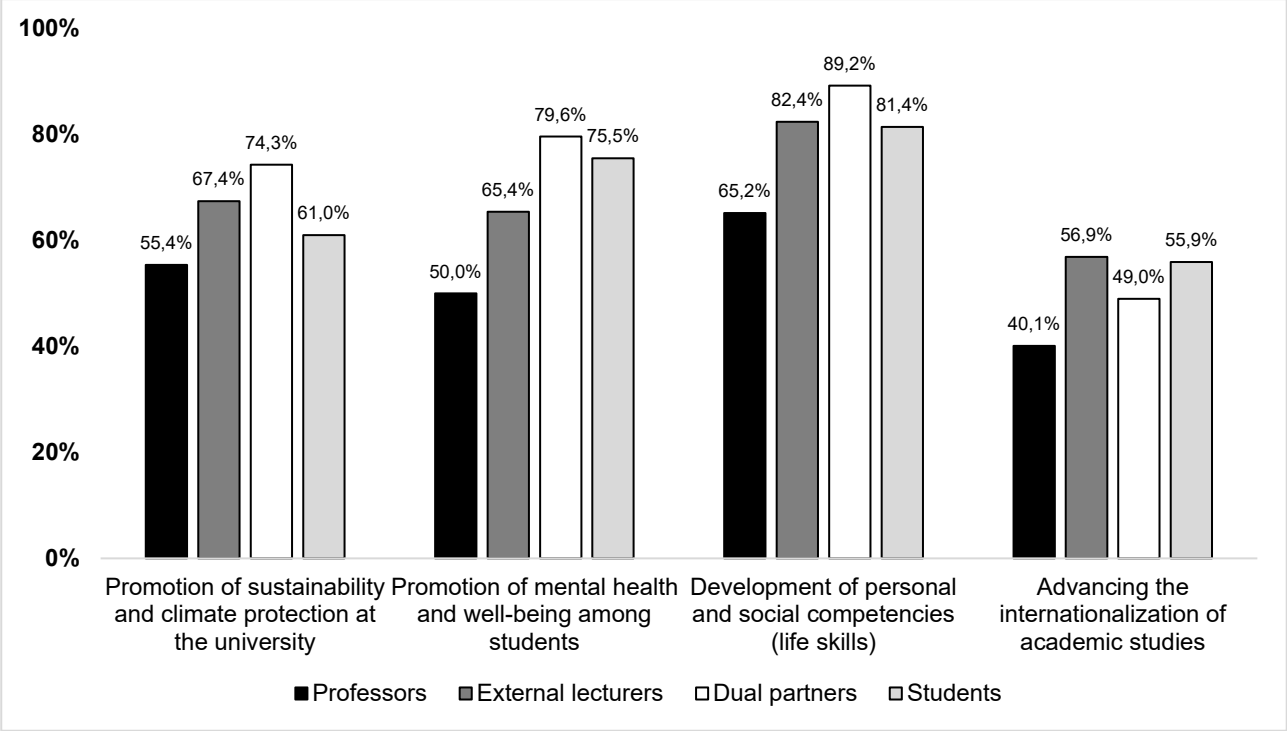

Figure 6. Sustainability, internationalisation, and personality development

The promotion of sustainability and climate protection at the university is supported by the majority of all stakeholder groups with dual partners having the highest approval rate (74.4%). The high approval rate among dual partners may be explained by their operational and corporate requirements. Companies are increasingly subject to regulations such as sustainability reporting, climate protection regulations, or requirements along global supply chains. At the same time, they face growing expectations from customers, investors, and the public. Accordingly, there is considerable interest in graduates who possess fundamental knowledge in the areas of environmental management, resource efficiency, sustainable production, or climate accounting (Leal Filho et al., 2025). The promotion of sustainability in dual study programmes can take various forms. In teaching, this may include the integration of sustainability-related content into existing modules, dedicated courses on climate protection, circular economy, as well as practice-oriented project work addressing real sustainability challenges faced by partner companies. Beyond teaching, sustainability also encompasses organisational aspects, such as energy- and resource-efficient campus concepts, sustainable mobility methods, or an overall environmentally conscious university organisation (Gerstung-Jungherr & Deuer 2024).

The promotion of mental health and well-being among students is highly valued by dual partners (79.6%) and students (75.5%), while the ratings are lowest among professors (50.0%). The high level of approval among students and dual partners points to a growing pressure of expectations to systematically anchor appropriate support and prevention measures (Hyseni Duraku et al., 2024). Such partly already existing measures may involve offers aimed at strengthening individual resilience, coping with stress, and managing performance pressure, as well as low-threshold counselling and coaching formats (Conley et al., 2013). Particularly in dual study programmes, which are recognised as intensive programmes characterised by high temporal compression and the parallel demands of academic study and company-based practice, the conscious management of one's own resources is highly relevant. Such measures can include programmes that address competencies such as self-awareness, self-regulation, self-efficacy, social competence, and problem-solving ability. Moreover, they can also address the capacity to assess stressful situations and to recognise whether they can be managed independently or whether support is required (adaptive coping competence). These skills that can be deliberately trained are of great importance not only for academic success but also for subsequent professional practice.

The development of personal and social competencies (life skills) is highly valued by students, external lecturers, and dual partners with approval ratings between 81.4% and 89.2%. The approval ratings among professors are again considerably lower with 65.2%. The high ratings by dual partners underscore the labour market relevance of these competencies. From their perspective, life skills constitute essential prerequisites for professional agency, teamwork, and leadership development, and are therefore decisive for the sustainable integration of students into work processes (Nasheeda et al., 2018). At the same time, they contribute to preparing students for complex professional and life situations, in which technical knowledge alone is insufficient. A concrete example of the targeted promotion of personal and social competencies in dual study programmes is the project "*DIRK Dual – Digital Reflection Tool for Competence Development in Dual Study Programs*" (Eigbrecht et al., 2024). This study-accompanying digital tool supports students in systematically reflecting on their professional competencies during practical phases and in further developing them throughout the entire course of study. Beyond subject-specific qualifications, the focus lies on the cultivation of future skills such as communication, teamwork, self-organisation, problem-solving competence, and a reflective use of digital tools. *DIRK Dual* integrates an ePortfolio tool and supplements it with a mentoring and coaching concept. In this way, students are not only supported in self-reflection but also receive ongoing feedback from practice partners and mentors.

The approval ratings for advancing the internationalisation of academic studies range from 40.1% among professors to 56.9% among external lecturers. International experiences can be realised in a variety of formats: traditional study-abroad semesters, practical phases in international partner companies, double-degree programmes, or international project collaborations in specific courses. These mobility options foster language proficiency, intercultural sensitivity, and global problem-solving skills - competencies of high relevance in an increasingly interconnected world (Baxter, 2017). For dual partners engaged in international business relations, students with these skills can represent a decisive advantage. A possible reason for the more reserved attitude of the professors may lie in the fact that many students already make use of the opportunities described. For example, in some places at the Baden-Wuerttemberg Cooperative State University, more than 40% of graduates have integrated a period of study abroad, which exceeds the average at many traditional universities. In addition, full-time professors may perceive potential organisational obstacles, complex curricular coordination processes, issues of recognition, or the safeguarding of academic standards as critical challenges in this context (de Wit, 2019).

4 Conclusions

The results of this article address the relevance of established characteristics of cooperative state universities as well as various potential areas for further development. Through the systematic inclusion of all relevant stakeholder groups, both overarching commonalities in assessments and group-specific differences in evaluations become visible, reflecting the diverse roles, expectations, and responsibilities within the dual education system.

Established characteristics of cooperative state universities

The evaluation of the six established characteristics of dual education programmes by the various stakeholder groups demonstrates that these continue to be regarded as highly relevant. In particular, the regular change between theoretical and practical phases receives approval ratings of over 90%, reflecting an almost unanimous consensus across all groups, thereby confirming its function as a core identity feature of dual education programmes (Gerstung-Jungherr & Deuer 2025a). Likewise, the feasibility of completing studies within the standard period of study is acknowledged by all stakeholders as an essential quality criterion. Above all, students and dual partners attach high importance to the predictability and reliability of the study trajectory.

Moreover, the findings indicate that the structural features that directly contribute to the assurance of teaching and supervisory quality are generally considered highly important, though some differences have emerged. The small-group teaching concept is particularly highlighted by professors and dual partners, whereas students and external lecturers assess this aspect as somewhat less relevant. The high proportion of external lecturers from professional practice receives

broad approval across all stakeholder groups; a similar pattern emerges in the evaluation of practice-oriented examination formats. These formats are regarded as a relevant structural feature especially by dual partners and external lecturers, while students and professors attribute comparatively less importance to them. Here, potential conflicts between an applied orientation, predictability, supervisory workload, and comparability of performance standards become apparent. These are conflicts that are structurally embedded in the dual study system and reflect differing interests between the stakeholders (Mordhorst & Jenert, 2022).

Overall, the results demonstrate that the established characteristics of dual study programmes continue to be regarded as important by the vast majority of stakeholders. At the same time, the differences among stakeholders with respect to individual features reveal divergent expectations that must be taken into account in the future development of dual education programmes.

Areas for development

The results reveal, in many cases, a broad consensus across all stakeholders. The necessity of adapting curricula and examination formats to the transformations triggered by artificial intelligence and preparing students specifically for the use of new digital technologies are particularly emphasised. In the same vein, a stronger promotion of interdisciplinary approaches within dual study programmes is stressed, enabling the handling of complex problems across disciplinary boundaries. Furthermore, a practice- and labour-market-oriented design of study programmes is identified as a central task, accompanied by a further intensification of the integration of theory and practice. In addition to these content-related and structural aspects, social dimensions are also gaining importance: the promotion of inclusion and the assurance of fair and non-discriminatory access to higher education, particularly for disadvantaged groups, are regarded by all stakeholder groups as important future tasks.

The results also show that professors view the least need for further development in many areas, whereas representatives of the dual partners often identify the greatest scope for action. This divergence can primarily be explained by the differing roles, experiences, and responsibilities within the dual education system (Mordhorst & Jenert, 2022). Dual partners are directly confronted with current developments in their daily practice, such as increasing demands for sustainability, diversity and inclusion, internationalisation, and digital competencies. For this reason, they seek optimal study conditions for “their” students - conditions that, in addition to subject-specific qualifications, also encompass the development of personal and social competencies (life skills) as well as the promotion of mental health. For them, students are often regarded as future professionals and long-term employees within the company.

Professors often evaluate the potential for further development more cautiously. This does not mean they reject innovation, but rather that they thoroughly weigh different factors. They possess a comprehensive overview of existing curricular structures, institutional frameworks, and established quality standards, and often perceive the status quo as appropriate. Moreover, they are more directly confronted with the practical limits of feasibility such as restricted personnel and financial resources, legal requirements, administrative burdens, or potentially conflicting objectives. For example, while internationalisation within dual study programmes may in principle be assessed positively, its implementation raises questions regarding compliance with the standard period of study, the recognition of examination results from foreign universities, and the safeguarding of academic quality standards (de Wit, 2019). In addition, it is the responsibility of the professors, as representatives of the university, to ensure the long-term preservation of curricular coherence and academic standards. This leads to a sharper distinction between desirable developmental goals and realistically achievable innovation measures. The more cautious evaluations therefore reflect less a lack of willingness to reform than an awareness of complexity, potential consequences, and the need for sustainable implementation.

There are several limitations to consider when interpreting the results of the present study. One limitation concerns the relatively low response rate among students (7.82%), which raises the possibility of non-response bias. It cannot be ruled out that students who chose to participate differ systematically from non-respondents in their perceptions of cooperative state universities. Although the response levels of the other stakeholder groups are higher, these differential response rates may affect the comparability of stakeholder perspectives and limit the generalisability of the student

CC BY NC

findings. Another limitation concerns the dichotomisation of the 7-point Likert scales, which inevitably entails a loss of information and may reduce statistical power. We chose this procedure to obtain a clear distinction between respondents who (rather) endorse the importance of an aspect and those who do not, and to facilitate communication of the findings to practitioners via easily interpretable percentages. Nevertheless, future research should, where possible, rely on more sophisticated analytical approaches in order to capture more nuanced differences in stakeholders' assessments. Moreover, the response format did not include open-ended comments. Future research could complement quantitative assessments with qualitative approaches (e.g., interviews, focus groups, or structured analyses of free text responses) to gain a deeper understanding of how stakeholders interpret and justify their evaluations. An additional point to consider is that the study focuses exclusively on a single cooperative state university, which restricts the generalisability of the findings. Future research could address this limitation by examining whether similar patterns emerge at other cooperative state universities and by comparing stakeholder perceptions with those at traditional universities or universities of applied sciences.

Overall, the findings suggest that, from the perspective of the respondents at the Baden-Wuerttemberg Cooperative State University, the current status may not call for a fundamental structural transformation but rather for targeted adaptations and fine-tuning of existing elements. At the same time, the results should be interpreted with caution and not be generalised to the system level without further corroborating evidence. Within the context studied, a central challenge appears to lie in safeguarding established characteristics and quality standards while maintaining sufficient openness to innovation. The present study provides an empirical basis that can inform further discussions and may offer initial substantive impulses. However, the specific measures that can or should be implemented depend on the respective scope for action, resources, and priorities of the stakeholders involved. In this regard, a systematic coordination between the university and dual partners seems particularly important to align curricular, organisational, and practice-related requirements. Likewise, the continuous inclusion of the perspectives of students and external lecturers may help to ensure that development processes remain both student-oriented and practice-oriented. Within this interplay, dual study programmes could potentially be further developed and shaped for the future, while recognising that additional research is needed before drawing broader system-level conclusions.

Statement on AI use in manuscript preparation

The authors used the tool Copilot to support the preparation of this manuscript. The AI tool assisted with language refinement, formatting references in APA style, and improving clarity of expression. The authors reviewed and approved all content generated by AI, and take full responsibility for the accuracy and integrity of the final manuscript.

References

Baxter, A. (2018). The benefits and challenges of international education: Maximizing learning for social change. In J. Dassin, R. Marsh, & M. Mawer (Eds.), *International scholarships in higher education*. Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-319-62734-2_6

Centrum für Hochschulbildung (2024). *Duales Studium in Deutschland* [Dual study programmes in Germany]. https://hochschuldaten.che.de/deutschland/duales-studium/

Conley, C. S., Durlak, J. A., & Dickson, D. A. (2013). An evaluative review of outcome research on universal mental health promotion and prevention programs for higher education students. *Journal of American College Health, 61*(5), 286–301. https://doi.org/10.1080/07448481.2013.802237

de Groot, L., Demeijer, F. A., Zweekhorst, M., & Urias, E. (2025). Multi-stakeholder networks in the higher education context: a configurative literature review of university-community interactions. *Journal of Higher Education Policy and Management, 47*(4), 490–508. https://doi.org/10.1080/1360080X.2025.2451445

de la Fuente, A., Cardeñoso, O., Chang, E. C., & colleagues. (2023). The role of problem-solving ability, beyond academic motivation, in college students' psychological adjustment. *Current Psychology, 42*, 17888–17897. https://doi.org/10.1007/s12144-022-02945-y

de Wit, H. (2019). Internationalization in higher education, a critical review. *SFU Educational Review, 12*(3). https://doi.org/10.21810/sfuer.v12i3.1036

Deuer, E. (2017). Rahmenbedingungen, Motive und mögliche Konsequenzen der Studien und Berufswahl in Industrie und Handel [Conditions, motives, and possible consequences of study and career choice in industry and commerce]. In S. F. Dietl, H. Schmidt, R. Weiß & W. Wittwer (Eds.), *Ausbilderhandbuch. Ergänzungslieferung* [Trainer's handbook, supplement; p. 1-23]. Wolters Kluwer.

Deuer, E. (2019). Hochschullehre dual gestalten [Designing university teaching in dual format]. In S. F. Dietl, H. Schmidt, R. Weiß, & W. Wittwer (Eds.), *Ausbilderhandbuch, Ergänzungslieferung* [Trainer's Handbook, Supplement; p. 1-24]. Wolters Kluwer.

Deuer, E. (2022). Nachwuchskräfterekrutierung mit dualen Studienplätzen – Motive der dual Studierenden und der kooperierenden Ausbildungsstätten [Recruiting young talent with dual study places – Motives of dual students and cooperating training institutions]. In *Handbuch der Aus- und Weiterbildung, Ergänzungslieferung* [Handbook of Training and Continuing Education, Supplement; p. 1-24]. Wolters Kluwer.

Deuer, E. (2024). Soziale Herkunft und finanzielle Situation dual Studierender – Analysen auf Basis einer Studierendenbefragung an der Dualen Hochschule Baden-Württemberg [Social background and financial situation of dual students: Analyses based on a student survey at the Baden-Wuerttemberg Cooperative State University]. In J. Siegers, E. Deuer, & J. Hagedorn (Eds.), *Handbuch der Aus- und Weiterbildung, Ergänzungslieferung* [Handbook of Training and Continuing Education, Supplement; p.1-40]. Wolters Kluwer.

Deuer, E., Miez-Mangold, P., & Thieme, E. (2024). Handlungsmöglichkeiten für eine zeitgemäße Weiterentwicklung der Lehre im Kontext des dualen Studiums [Options for contemporary development of teaching in the context of dual studies]. In J. Siegers, E. Deuer, & J. Hagedorn (Eds.), *Handbuch der Aus- und Weiterbildung, Ergänzungslieferung* [Handbook of Training and Continuing Education, Supplement; p.1-38]. Wolters Kluwer

Deuer, E., & Träger, M. (2015). Duale Studiengänge eröffnen neue Potenziale für die betriebliche Personalarbeit [Dual study programmes open new potentials for company human resource management]. In T. Brüggemann & E. Deuer (Eds.), *Berufsorientierung aus Unternehmenssicht – Fachkräfterekrutierung am Übergang Schule-Beruf* [Career orientation from the company perspective – Recruitment of skilled workers at the transition from school to work] (pp. 187–198). wbv Publikation.

Deuer, E., & Wild, S. (2017). *Akzeptable Schwundquote im dualen Studium aus der Perspektive von Professor*innen, Studierenden und Dualen Partnern* [Acceptable dropout rate in dual studies from the perspective of professors, students, and dual partners]. In Arbeitspapiere des Studienverlaufspanels „Weichenstellungen, Erfolgskriterien und Hürden im Verlauf des dualen Studiums an der DHBW" [Working papers of the study progress panel "Decisions, success criteria and hurdles in the course of dual studies at DHBW"].

Hyseni Duraku, Z., Davis, H., Arënliu, A., Uka, F., & Behluli, V. (2024). Overcoming mental health challenges in higher education: A narrative review. *Frontiers in Psychology, 15*, 1466060. https://doi.org/10.3389/fpsyg.2024.1466060

Eigbrecht, L., Allmang, J., & Ehlers, U.-D. (2024). Brücken bauen für die Zukunft: Wie DIRK Dual Future Skills ins duale Studium integriert [Building bridges for the future: How DIRK Dual Future Skills are integrated into dual studies]. In H. Koch, C. Schneider, & U. Wilke (Eds.), *Future Skills lehren und lernen. Schlaglichter aus Hochschule, Schule und Weiterbildung* [Teaching and learning future skills: Highlights from university, school, and continuing education] (pp. 164–175). Stifterverband.

Erbe, B. (2020). Exzellent und geschlechtergerecht? Universitäre Strategien zur gleichstellungspolitischen Einbindung der akademischen Profession [Excellent and gender equitable? University strategies for the gender equality policy integration of the academic profession]. *Beiträge zur Hochschulforschung, 2*, 70–81.

Fink, M. C., Kaltefleiter, L. J., Reis, I., & Ertl, B. (2025). Format-specific expectations explain preferences and perceived fairness: A study on four common examination formats. *Assessment & Evaluation in Higher Education, 50*(7), 1066–1086. https://doi.org/10.1080/02602938.2025.2501689

Gerstung-Jungherr, V., & Deuer, E. (2025a). *Theorie-Praxis-Verzahnung im dualen Studium. Verstehen, gestalten, umsetzen* [Theory-practice integration in dual studies: Understanding, designing, implementing]. Springer.

Gerstung-Jungherr, V., & Deuer, E. (2025b). *Künstliche Intelligenz im dualen Studium: Eine vergleichende Analyse der Perspektiven und Praktiken von Stakeholdern des dualen Studiums* [Artificial intelligence in dual studies: A comparative analysis of perspectives and practices of stakeholders in dual studies]. Hochschulforschung an der DHBW: Aktuelle Erkenntnisse aus dem Studienverlaufspanel 25/2025 [University research at DHBW: Current findings from the study progress panel 25/2025].

Gerstung-Jungherr, V., & Deuer, E. (2024). Wie nachhaltig ist die Hochschule? Eindrücke, Wünsche und Einstellungen von dual Studierenden zu Nachhaltigkeit und Umweltschutz [How sustainable is the university? Impressions, wishes, and attitudes of dual students on sustainability and environmental protection]. In E. Deuer & S. Meyer (Eds.), *Vom Studienstart bis zum Berufseinstieg. Motive, Herausforderungen und Zukunftsperspektiven im dualen Studium* [From study start to career entry: Motives, challenges, and future perspectives in dual studies] (pp. 151–179). Wbv Publikation.

Hazelkorn, E. (2015). *Rankings and the reshaping of higher education: The battle for world class excellence*. Palgrave Macmillan.

Hettler, I. S., Badermann, M., Meyer, T., Gerstung, V., & Deuer, E. (2021). *Online-Lehre während der COVID-19-Pandemie: Die Perspektive der Lehrenden* [Online teaching during the COVID-19 pandemic: The perspective of lecturers]. In Forschungsberichte des Studienverlaufspanels „Weichenstellungen, Erfolgskriterien und Hürden im Verlauf des dualen Studiums an der DHBW", Arbeitspapier 9/ [2021Research reports of the study progress panel "Decisions, success criteria and hurdles in the course of dual studies at DHBW", Working Paper 9/2021].

Jürgensen, I. N., Koch, P., Nock, A. M., & Petersen-Ewert, C. (2023). Health of (dual) health professional students in German-speaking countries: a scoping review. *Frontiers in public health, 11*, 1243324. https://doi.org/10.3389/fpubh.2023.1243324

Kolano, L., Zurmühl, A.-B., & Ternes, D. (2023). Forschendes Lernen an der DHBW – Gelingensbedingungen und Entwicklungschancen [Inquiry-based learning at DHBW – Success conditions and development opportunities]. In J. Hufnagel, D. Ternes, & C. Schnekenburger (Eds.), *Aufbau eines Education Competence Networks – Lehre und Lehrsupport digital und nachhaltig denken* [Establishing an Education Competence Network – Rethinking teaching and support digitally and sustainably] (pp. 27–40). ZHL publication series for DHBW.

Leal Filho, W., Viera Trevisan, L., Sivapalan, S., & colleagues. (2025). Assessing the impacts of sustainability teaching at higher education institutions. *Discover Sustainability, 6*, 227. https://doi.org/10.1007/s43621-025-01024-z

Long, T. T., Lam, N. T., & Cuong, T. Q. (2025). AI integration into curriculum design and development: Theoretical framework and application. In S. Pal & Á. Rocha (Eds.), *Proceedings of 4th International Conference on Mathematical Modeling and Computational Science (ICMMCS 2025)* (Lecture Notes in Networks and Systems, Vol. 1399). Springer, Cham. https://doi.org/10.1007/978-3-031-91005-0_32

Loorbach, D. A., & Wittmayer, J. M. (2024). Transforming universities: Mobilizing research and education for sustainability transitions. *Sustainability Science, 19*, 19-33. https://doi.org/10.1007/s11625-023-01335-y

Luekitinan, W. (2018). The impact of cooperative education: Considering employability and career advancement of new graduates. International *Journal of Information and Education Technology, 8*(10), 725-729. https://doi.org/10.18178/ijiet.2018.8.10.1129

Marom, L., & Hardwick, J. (2025). From access to inclusion: A call for a cultural shift in higher education. *Higher Education, 89*, 513–534. https://doi.org/10.1007/s10734-024-01233-x

Mordhorst, L., & Jenert, T. (2023). Curricular integration of academic and vocational education: A theory-based empirical typology of dual study programmes in Germany. *Higher Education, 85*, 1257–1279. https://doi.org/10.1007/s10734-022-00889-7

Nasheeda, A., Abdullah, H. B., Krauss, S. E., & Ahmed, N. B. (2019). A narrative systematic review of life skills education: effectiveness, research gaps and priorities. *International Journal of Adolescence and Youth, 24*(3), 362–379. https://doi.org/10.1080/02673843.2018.1479278

Olson, N., Oberhoffer-Fritz, R., Reiner, B., & colleagues. (2025). Stress, student burnout and study engagement – A cross-sectional comparison of university students of different academic subjects. *BMC Psychology, 13*, 293. https://doi.org/10.1186/s40359-025-02602-6

Petrova-Stoyanov, R., Altenstädter, L., Wegrzyn, E., & Klammer, U. (2020). Exzellenz oder Frauenförderung? Gleichstellungswissen und -handeln von Professorinnen und Professoren in Berufungskommissionen [Excellence or promotion of women? Gender equality knowledge and action of professors in appointment committees]. *Beiträge zur Hochschulforschung, 2*, 50–69.

Resch, K. (2023). Student voice in higher education diversity policies: *A systematic review. Frontiers in Education, 8*, 1039578. https://doi.org/10.3389/feduc.2023.1039578

Scholkmann, A., Sutherland, S.D., & Wollscheid, S. (2024). Perspectives on disruptive change in higher education. A critical review of digital transformation during COVID-19. *Higher Education Research & Development, 43*(6), 1355-1369. https://doi.org/10.1080/07294360.2024.2325140

Silseth, K., & Furberg, A. (2024). Bridging group work and whole-class activities through responsive teaching in science education. *European Journal of Psychology of Education, 39*, 2155–2176. https://doi.org/10.1007/s10212-023-00770-w

Taylorson, J., Mavor, K., & Miles, P. (2025). Applying a psychological lens to educators' professional identity: The case of English for Academic Purposes educators. *Review of Education, 13*, e70102. https://doi.org/10.1002/rev3.70102

Vladova, G., Haase, J., & Friesike, S. (2025). Why, with whom, and how to conduct interdisciplinary research? A review from a researcher's perspective. *Science and Public Policy, 52*(2), 165–180. https://doi.org/10.1093/scipol/scae070

Wissenschaftsrat. (1993). *10 theses on higher education policy* [10 Thesen zur Hochschulpolitik]. Köln: Wissenschaftsrat.

Wissenschaftsrat (1994). *Stellungnahmen zu den Berufsakademien in Baden-Württemberg* [Recommendations on higher education policy]. Schwerin: Wissenschaftsrat. http://www.wissenschaftsrat.de/download/archiv/1570-94

Wissenschaftsrat (1996). *Stellungnahme zur Feststellung der Gleichwertigkeit der Abschlüsse der Berufsakademie Berlin im Sinne des Beschlusses der Kultusministerkonferenz vom 29.9.1995* [Statement on the determination of the equivalence of degrees from the Berufsakademie Berlin according to the decision of the Conference of Ministers of Education from September 29, 1995]. Cottbus, Wissenschaftsrat. http://www.wissenschaftsrat.de/download/archiv/2566-96.pdf?__blob=publicationFile&v=1

Wissenschaftsrat (2004). *Stellungnahme zur Evaluation der Berufsakademie in Trägerschaft der Wirtschaftsakademie Schleswig-Holstein* [Statement on the evaluation of the Berufsakademie operated by the Wirtschaftsakademie Schleswig-Holstein]. Berlin, Wissenschaftsrat. https://www.wissenschaftsrat.de/download/archiv/5912-04.pdf?__blob=publicationFile&v=1

European Scientific Journal for Dual Higher Education

Vol. 2, No. 2 (2026)
ISSN (online): 3052-7015

PROMOTING AI LITERACY: DEVELOPMENT, IMPLEMENTATION AND INITIAL VALIDATION OF AN AI COMPETENCY MODEL FOR HIGHER EDUCATION (AICM-HE)

Nils Aschhoff [1], *Claudia Berg* [2], *Manuel Geisler* [2], *Miriam Hägerbäumer* [2*], *Vera Lenz-Kesekamp* [2] *and Miriam Stehling* [2]

[1] *Federal University of Applied Administrative Sciences, Germany*

[2] *Euro-FH University of Applied Sciences, Germany*

Keywords:
AI literacy
Competency model
Higher education
Curriculum development
Implementation strategy

Article history:
Received: 19 December 2025
Revised: 31 March 2026
Accepted: 13 April 2026

To cite this article:
Aschoff, N., Berg, C., Geisler, M., Hägerbäumer, M., Lenz-Kesekamp, V. & Stehling, M. (2026). Promoting AI Literacy: Development, Implementation and Initial Validation of an AI Competency Model for Higher Education (AICM-HE). European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), 53-66.
https://doi.org/10.82321/07MA-34M65

Abstract
The rapid integration of Artificial Intelligence (AI) into the workplace and society requires higher education institutions to adapt their curricula in order to foster students' AI literacy. This paper presents the development, implementation, and initial validation of a comprehensive AI competency model designed for systematic and flexible integration into higher education. The AI Competency Model for Higher Education (AICM-HE) synthesises established theoretical frameworks into a multidimensional structure, comprising three content sectors (technical understanding, critical evaluation, and practical application) and three proficiency levels (basic competencies, professional use, expert level). This design avoids a "one-size-fits-all" approach and addresses the diverse needs of a heterogeneous student body. To facilitate university-wide adoption, an interactive online platform was developed as the central implementation tool. To assess practical relevance and applicability, the model and the platform were evaluated in a workshop with academic staff. The results indicate strong acceptance of the model's clarity, scientific foundation, and utility for teaching. This paper contributes a scientifically grounded and practice-validated framework that can serve as a blueprint for universities aiming to systematically embed AI competencies into their curricula and prepare graduates for an AI-driven future.

1 Introduction

The integration of Artificial Intelligence (AI) represents one of the most profound transformations of the 21st century, reshaping labour markets, educational landscapes and societal structures (OECD, 2023). In particular, the broad availability of generative AI systems has created a disruptive dynamic that challenges higher education institutions (HEIs) to move beyond reactive adjustments and proactively prepare students for an AI-centred future (Bobula, 2024; Southworth et al., 2023). This requires the systematic development of a specific set of competencies, collectively known as *AI literacy*. AI literacy is considered a key component of *Future Skills*. These encompass

* Corresponding author
E-mail address: Miriam.Haegerbaeumer@euro-fh.de

a comprehensive set of competencies, capabilities and personal qualities that enable individuals to autonomously tackle complex problems, even when operating within unfamiliar or entirely new contexts and environments (Ehlers, 2023).

According to current understandings of AI literacy, AI competence extends far beyond programming skills. Instead, it is conceived as a multidimensional construct that combines technical understanding with critical reflection and practical application. A fundamental and frequently cited definition by Long and Magerko (2020) describes AI literacy as a set of competencies that enables individuals to critically evaluate AI, communicate effectively with it, and use it as a tool. This holistic approach has been confirmed and expanded in recent research. Zhang et al. (2024) found general consensus in their umbrella review of 17 systematic reviews, emphasising that AI literacy encompasses "a range of skills that foster a comprehensive understanding of AI and enable individuals to purposefully explore AI technologies and thoughtfully assess their implications for both personal learning gains and social impact" (p. 15). Allen and Kendeou (2024) further emphasise that AI competence includes the ability to "communicate and collaborate with AI in productive ways" (p. 4). Therefore, AI literacy is a meta-competence that integrates technical understanding with critical reflection and practical application (Cox, 2024; Ng et al., 2021). Recent systematic reviews have identified consistent core constructs that underpin AI literacy frameworks. Almatrafi et al. (2024) synthesised six fundamental dimensions from their analysis of 47 articles: Recognise, Know & Understand, Use & Apply, Evaluate, Create and Navigate Ethically. These constructs provide a comprehensive foundation for understanding AI literacy, though their implementation in educational contexts varies significantly. Notably, while "Evaluate" and "Navigate Ethically" appeared in 91% of the reviewed implementations, "Create" was addressed less frequently, at only 64% (Almatrafi et al., 2024). This variation highlights the ongoing challenge of translating theoretical frameworks into practical, implementable curricula.

Building on this concept of AI literacy, HEIs face the immediate and pressing challenge of integrating AI literacy into their curricula. A didactic model is therefore needed to translate the abstract concept of AI literacy into concrete, teachable competencies at different levels of depth, suitable for a wide range of academic disciplines (Southworth et al., 2023).

Zhang et al. (2024) identified critical gaps in current approaches, including the lack of theoretical grounding in many existing tools, insufficient integration across disciplines, and inadequate faculty preparation for teaching AI concepts. Many existing AI literacy tools and curricular designs lack a solid foundation in theoretical or conceptual frameworks, limiting their pedagogical effectiveness and integration potential. Furthermore, while AI's impact extends across all disciplines, teaching materials often remain confined to STEM contexts, with insufficient integration into humanities and social sciences.

Closely linked to the necessity of integrating AI literacy into education is the need to assess the development of AI-related competencies. Consequently, the need to assess AI literacy is widely recognised in the scientific community. A recent systematic review by Lintner (2024) identified 16 different scales designed to measure AI literacy. However, the review – using the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN; Mokkink et al., 2010) to evaluate the methodological quality of the individual studies – also revealed significant weaknesses in the existing landscape of assessment tools, noting that "none of the scales showed positive evidence for all COSMIN measurement properties and most studies suffered from poor methodological rigour" (Lintner, 2024, p. 7). A particularly critical gap identified is the lack of content validation involving the target population, meaning many instruments have not been sufficiently tested for their relevance and comprehensibility among those expected to use them. Lintner (2024) found that while scales generally demonstrated good structural validity and internal consistency, "only a few have been tested for content validity, reliability, construct validity, and responsiveness" and "none of the scales have been tested for cross-cultural validity and measurement error" (p. 1). Most critically, the majority of studies did not involve target populations in content validation processes, limiting the practical utility and acceptance of these frameworks in educational settings.

This validation gap has profound implications for HEIs seeking to implement AI literacy frameworks. Without proper stakeholder involvement and content validation, even theoretically sound models may fail to achieve practical utility or acceptance among faculty and students. Zhang et al. (2024) emphasise that co-design with teachers and stakeholders is essential not only for

curriculum development but also for addressing the practical challenges educators face in integrating AI concepts across diverse academic disciplines.

Building on the outlined challenges, this paper addresses both the implementation and validation gaps. We present the development, implementation, and stakeholder validation of a competency model for AI literacy at a German university of applied sciences for distance learning. The model serves not merely as an assessment instrument but as a strategic tool for curriculum design. It is supported by a comprehensive implementation strategy that features an interactive online platform. The model aims to provide a common language and a reliable framework for the university-wide, systematic promotion of AI competencies across diverse academic disciplines and varying levels of technical expertise. Our contribution is structured as follows: First, we introduce the AICM-HE, a novel multidimensional model. It synthesises the structural findings of Laupichler et al. (2023) with the level-based approach of Teuber et al. (2022) into a flexible framework. Second, we describe an implementation strategy for integrating the model at the institutional level. We describe the architecture and functionality of the supporting online platform, demonstrating how it bridges the gap between theoretical frameworks and practical classroom application. Third, we present the results of a comprehensive stakeholder validation workshop with academic staff. This directly addresses the validation gap identified by Lintner (2024) and ensures the model's practical utility and acceptance.

2 Method

The development and validation of the AICM-HE followed a multiphase, mixed-methods approach within a cyclical, iterative framework designed for continuous improvement. As illustrated in Figure 1, the initial cycle described in this study comprised three distinct phases: (1) the literature-based, interdisciplinary conceptualisation of the model, (2) the technical implementation and institutional integration, and (3) an initial validation and feedback process with key stakeholders to assess the model's comprehensibility, foundation, and utility. The insights gained from this initial validation serve as the foundation for subsequent feedback loops aimed at continuously refining and optimising the model.

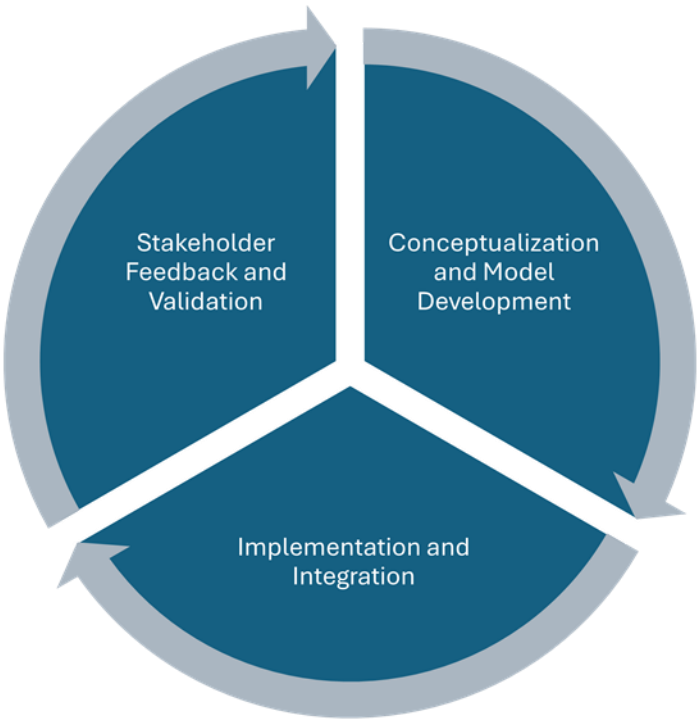

Figure 1. The AI Competency Model for Higher Education (AICM-HE) development and validation process

2.1 Phase 1: Conceptualisation and model development

The competency model was developed by an interdisciplinary project team at the Euro-FH University of Applied Sciences based on an extensive review of existing scientific literature. The goal was to create a model that is (1) relevant to future professional fields, (2) applicable across various disciplines, (3) differentiated to accommodate varying competency levels, and (4) specific enough to be practically implemented.

The model's structure is a synthesis of two highly influential frameworks in AI literacy research. The content dimension of the model, comprising three core sectors, is based on the factor-analytically validated structure proposed by Laupichler et al. (2023). Their "Scale for the assessment of non-experts' AI literacy" (SNAIL) is one of the most rigorously developed instruments to date and is described by Lintner (2024) as a "promising instrument" due to its foundation in an elaborate Delphi study and its multiple revalidation studies. This framework ensures that our model covers the essential pillars of AI literacy: Technical Understanding, Critical Evaluation, and Practical Application.

For the model's vertical differentiation, we adapted the approach of Teuber et al. (2022), who argue that AI competency requirements vary depending on an individual's role and depth of interaction with the technology. Teuber et al. (2022) propose a crucial conceptual framework that recognises the heterogeneous nature of AI literacy needs across different user groups and contexts. Their differentiation into three distinct levels provides a systematic approach to competency development: foundational AI basic competencies for the general population, advanced competencies for professional AI use in occupational contexts, and specialised competencies for AI experts.

This tiered approach acknowledges that not all individuals require the same depth of AI knowledge and skills. While basic AI literacy serves as a foundation for informed participation in an AI-driven society, professional users need more sophisticated competencies to effectively integrate AI tools into their specific work domains. At the highest level, AI experts require specialised technical, methodological and ethical competencies for designing, developing, and managing AI systems. This differentiation enables the tailored design of learning objectives and content, facilitating both broad foundational education and field-specific specialisation.

We transferred this concept to the higher education context by defining three progressive competency levels: Basic AI Competencies, Professional AI Use, and AI Expert Level. This adaptation recognises that HEIs serve diverse student populations with varying career trajectories and AI interaction requirements. The progressive structure allows institutions to provide comprehensive AI literacy for all students while enabling specialised pathways for those pursuing AI-intensive careers, thereby addressing both the democratisation of AI knowledge and the development of specialised expertise.

This two-part synthesis forms the structural basis of the model. However, the specific content populating this matrix was not simply derived from the underlying models. Instead, the individual competency descriptions were defined through a comprehensive additional literature review and iteratively refined in internal expert discussions. This process resulted in a multidimensional framework that systematically maps out 29 distinct, granularly defined competencies.

2.2 Phase 2: Technical implementation and institutional integration

To anchor the competency model in teaching practice, the theoretical framework was translated into a digital support system. The development of the accompanying interactive online platform followed an agile approach, enabling iterative feedback loops with the university's e-learning department. For the technical realisation, an established web-based environment (Articulate Rise 360) was used to ensure low-threshold access for all user groups. This architectural decision deliberately prioritises accessibility, allowing both internal faculty and external teaching staff to use the platform flexibly without the need for complex Learning Management System (LMS) authentication or navigation. Furthermore, a streamlined submission workflow was established to facilitate the continuous integration of new teaching materials by the faculty members. This workflow ensures that the platform remains dynamic and up-to-date.

The platform serves as a central hub for all instructors, designed with both didactic and application-oriented objectives in mind. It provides a comprehensive overview of the AICM-HE model as well as its context and theoretical background. Furthermore, it provides explanations on the distinct content dimensions and competency levels. At the individual competency level, the definitions are explained and enriched with examples describing applications of the respective competency. This virtual platform thus enables educators to use it according to their specific needs.

In line with a best-practice approach, the platform provides educators with a curated collection of AI-related teaching materials already in use at the university, ranging from individual study booklets and courses to complete study units and modules. A workflow has been established through which educators can submit their own materials for inclusion. An expert group evaluates these proposals to ensure their suitability. This fosters a living repository that promotes quality in AI-related teaching and encourages interaction among the faculty members.

To further institutionalise the model, its application is integrated into university-wide guidelines for programme development. Templates for module descriptions were developed including suggested formulations for AI-related learning outcomes that directly reference the competency model. Additionally, educators are continuously informed about the competency model and new developments. Looking ahead, the ongoing development and assessment of the applicability and fit of the model are intended to be systematised and institutionalised.

2.3 Phase 3: Stakeholder feedback and validation

To address the critical validation gap identified in the literature (Lintner, 2024) and to assess the model's practical relevance and acceptance, a feedback and validation workshop was conducted with key stakeholders. The goal was to gather both quantitative and qualitative data from the model's intended users – the academic teaching staff. Since the AICM-HE was intended to address different levels of application and be applicable across various disciplines, it is crucial for the validation of the model to involve stakeholders from different disciplines and with responsibilities across various programme levels.

- **Participants:** A total of 21 key stakeholders participated in the evaluation workshop, which was held as part of a university-wide strategy meeting for educators on 18 September 2025. The sample was intentionally designed to move beyond a purely academic validation by incorporating a wide range of institutional perspectives. While the core of the group consisted of professors with programme and module responsibilities and research associates from all academic departments, their pedagogical feedback was complemented by strategic and operational insights from other key areas. The participation of the President, the Chancellor and the Vice President for Accreditation ensured that the model was evaluated for its strategic fit and its compatibility with university-wide quality assurance and curricular development processes. Furthermore, representatives from the department for digital teaching media provided critical feedback on the model's technical feasibility and integration with the university's digital learning ecosystem. Insights from the department coordinating external teaching staff were vital for assessing how the model could be effectively communicated and implemented among diverse and geographically distributed teaching staff. This multi-stakeholder approach was crucial for validating the model's practical relevance and institutional viability.
- **Procedure:** The workshop procedure was designed to elicit structured and open feedback. Following a 10-minute presentation of the competency model, a 50-minute interactive session was conducted. Participants provided anonymous written feedback on five thematically distinct Metaplan walls. Quantitative data on the model's clarity, perceived foundation, complexity, helpfulness, and usability were collected via dot voting on 5-point and 10-point scales. Qualitative data consisted of written comments addressing the model's utility, suggestions for the online platform, and ideas for measuring implementation success.

- **Data analysis:** The quantitative data were analysed descriptively to calculate means and standard deviations. The qualitative comments were transcribed, thematically clustered, and synthesised by the development team to identify key themes and actionable suggestions for future iterations of the model and its supporting platform.

3 Results and discussion

This section presents the final competency model followed by the results of the stakeholder validation workshop. The findings are then discussed in the context of the current scientific discourse.

3.1 The multidimensional AI competency model

The developed model is a multidimensional framework designed to guide curricular integration (see Figure 2). The three sectors form the content pillars, while the three levels allow for didactic differentiation.

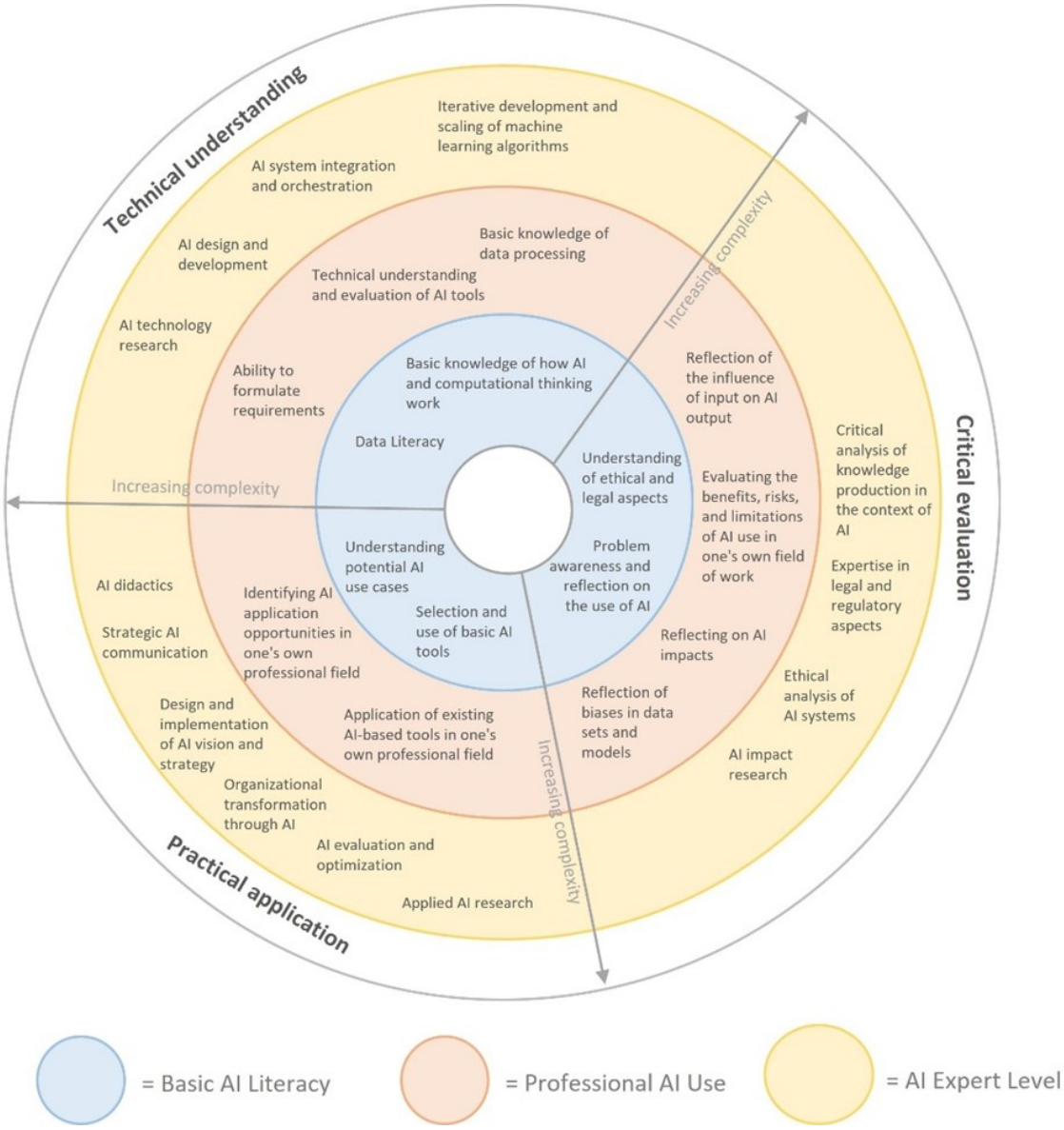

Figure 2. The AI Competency Model for Higher Education (AICM-HE), structured by three sectors and three levels

3.1.1 Sectors (The "What"):

- **Technical Understanding:** Forms the knowledge base for informed engagement with AI. It includes competencies ranging from basic data literacy to understanding the principles of machine learning algorithms.
- **Practical Application:** Bridges the gap between knowledge and action. This sector focuses on the ability to use AI tools productively in academic and professional contexts, from selecting appropriate applications to strategically integrating AI into organisational workflows.
- **Critical Evaluation:** Encompasses the competencies required for a responsible and reflective use of AI. This includes the ability to recognise algorithmic bias, understand ethical and legal implications, and assess the societal impact of AI systems.

3.1.2 Levels (The "How Deep"):

- **Basic AI Competencies:** This foundational level targets all students and aims to foster a general AI literacy necessary for informed societal participation.
- **Professional AI Use:** This intermediate level is for students who will actively use AI tools in their future professional fields. Competencies are more context-specific, focusing on advanced application and domain-specific ethical reflection.
- **AI Expert Level:** This advanced level is designed for students in specialised, AI-related degree programmes. It includes in-depth technical skills required for designing, developing, and managing AI systems.

The intersection of these sectors and levels yields a matrix of 29 specifically defined competencies, each with detailed descriptions and practical examples, which serve as a direct basis for formulating learning outcomes in module descriptions. Table 1 shows examples from different sectors and levels, showcasing each combination of level and sector once.

Table 1. Example competency descriptions of the AICM-HE for different sectors and levels

Level	*Sector*	*Competency*	*Definition*
Basic AI Competencies	Technical Understanding	Basic knowledge of how AI and computational thinking work	Understanding how artificial intelligence makes decisions based on data without in-depth technical knowledge of algorithms or models. This includes the ability to recognise the principles and applications of AI in everyday life. It also includes the ability to approach complex problems in a structured manner by breaking them down into smaller, solvable subproblems in order to develop practical solutions.
Basic AI Competencies	Practical Application	Selection and use of basic AI tools	The ability to identify accessible AI applications for one's own needs, understand their functionality, and apply them securely and purposefully for specific tasks in work, learning, and everyday contexts. This also includes evaluating their suitability for particular use cases.
Basic AI Competencies	Critical Evaluation	Understanding of ethical and legal aspects	Knowledge of data privacy, copyright, fairness, and transparency, as well as the responsibility in handling AI systems. It encompasses the ability to identify potential societal, legal, and ethical challenges and to ensure that AI technologies are used responsibly and in accordance with applicable norms.

Table 1. Example competency descriptions of the AICM-HE for different sectors and levels (continued)

Level	*Sector*	*Competency*	*Definition*
Professional AI Use	Technical Understanding	Technical understanding and evaluation of AI tools	Ability to grasp fundamental concepts, principles, and algorithms of Artificial Intelligence, as well as to evaluate AI tools. This competency includes knowledge of the functionality and application areas of AI, as well as the ability to critically evaluate their utility, quality, and appropriateness in a professional context. It enables individuals to recognise the role of AI technologies and to assess their potential to transform work processes.
Professional AI Use	Practical Application	Application of existing AI-based tools in one's own professional field	The ability to effectively utilise these technologies to improve workflows and optimise outcomes. This competency requires an understanding of the tools' functionalities and their targeted application in professional daily life.
Professional AI Use	Critical Evaluation	Evaluating the benefits, risks, and limitations of AI use in one's own field of work	The ability to critically evaluate the use of AI with regard to its (potential) contribution to achieving professional goals, upholding profession-specific standards and requirements, and its impact on one's own work and the profession as a whole, and to relate these aspects to one another. This includes independent reflection as well as professional discourse.
AI Expert Level	Technical Understanding	AI design and development	The creative and technical process of creating new AI systems. This includes the choice of suitable model architectures, the thoughtful selection of training data, the design of user interfaces for AI-powered applications, as well as the development of robust and interpretable solutions for various industries and tasks.
AI Expert Level	Practical Application	AI evaluation and optimization	Competence in continuously enhancing AI applications in practice. This includes analysing actual performance in deployment, adapting to changing requirements, identifying and addressing weaknesses, and implementing measures to improve efficiency and fairness – with a focus on practical application rather than just theoretical model improvements.
AI Expert Level	Critical Evaluation	Ethical analysis of AI systems	Competence in evaluating AI technologies with regard to ethical principles such as fairness, transparency, and accountability, as well as sustainability. This includes the identification and minimisation of discrimination, the development of ethical guidelines for the use of AI, and raising awareness of moral dilemmas in AI-supported decisions.

3.2 Implementation strategy and online platform

A key result of this project is the concrete implementation strategy, realised through an interactive online platform that supports the theoretical AICM-HE model. This platform serves as a central hub for instructors, bridging the gap between the abstract competency model and practical teaching.

The platform visualises the multidimensional structure of the AICM-HE. As shown in Figure 3 and Figure 4, educators can interactively navigate through the sectors and levels. By selecting a specific competency (e.g., "Data Literacy" within the intersection "Technical Understanding"), users receive the precise definition alongside practical application examples and teaching materials.

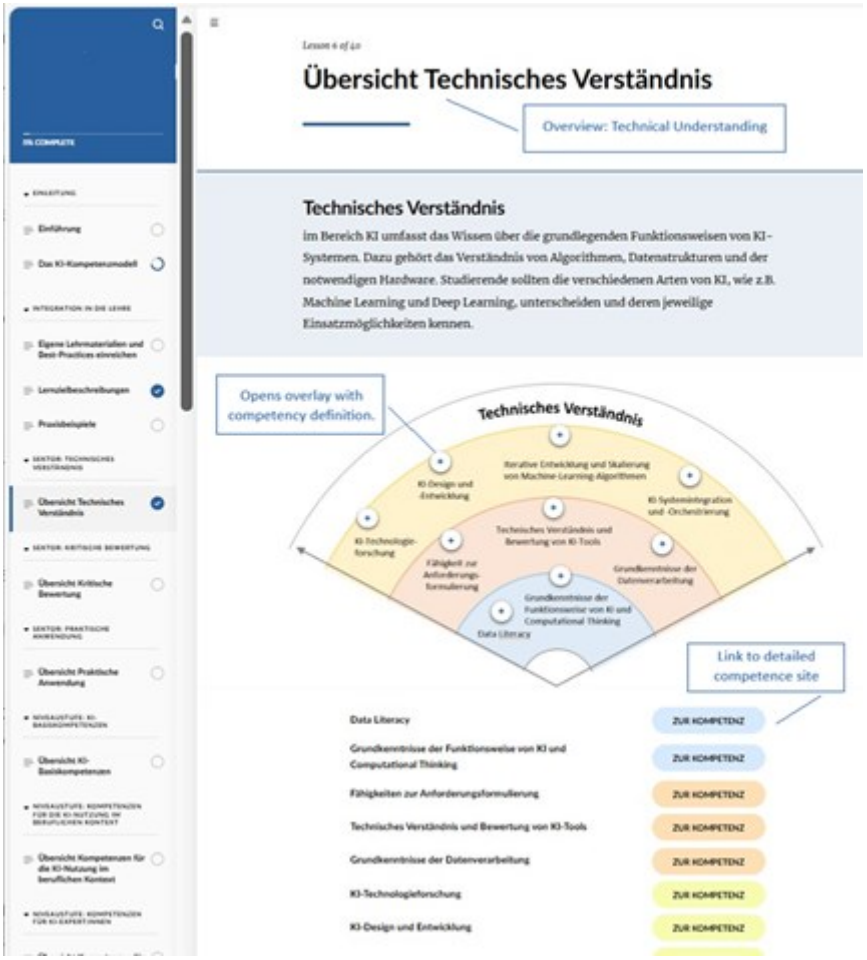

Figure 3. User interface of the AICM-HE online platform: "Technical Understanding" sector (explanations in English in blue font)

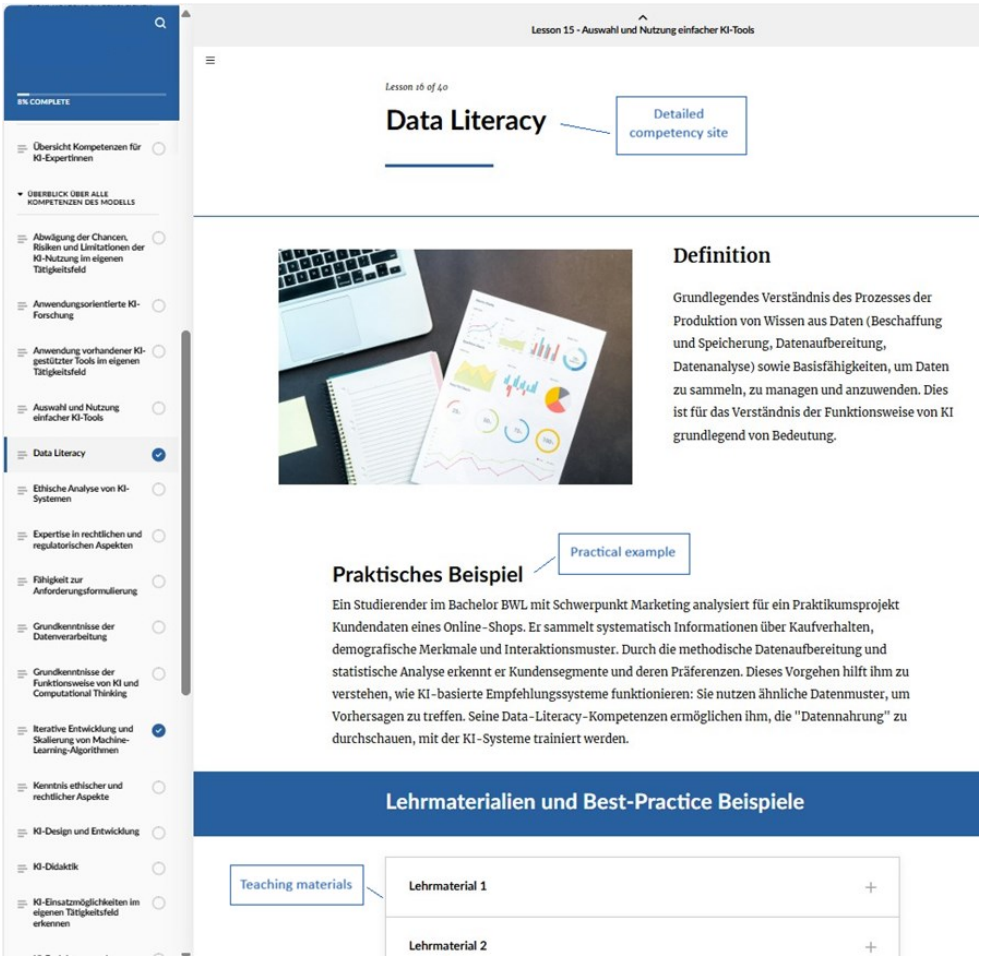

Figure 4. User interface of the AICM-HE online platform: "Data Literacy" competency page (explanations in English in blue font)

The platform provides a curated repository of AI-related teaching materials mapped to the competencies. This feature allows faculty members to find suitable resources – ranging from specific study booklets to complete modules – directly linked to the desired learning outcomes. If faculty members, for example, are looking for materials to develop the "Data Literacy" competency in their degree programme, they open the competency's detail page and find suggested teaching materials they can use. They check whether the materials fit their degree programme and learning objectives and then either use them directly or adapt them for their purposes.

The implementation strategy extends beyond the digital tool. The model has been successfully integrated into the university's curricular governance. Templates for module descriptions now include preformulated learning outcomes based on the AICM-HE, enabling a standardised yet flexible application across different departments.

3.3 Stakeholder validation results

The workshop provided strong evidence for the model's acceptance and perceived utility among academic staff. The quantitative ratings were consistently positive (see Table 2). Because participants without teaching responsibilities also participated in the workshop, the number of valid answers varied.

Table 2. Quantitative results from the stakeholder workshop

Assessment Question	*Scale*	*Mean (M)*	*Std. Dev. (SD)*	*N*
Clarity of the model	1 (unclear) - 5 (very clear)	4.70	0.46	20
Perceived foundation of the model	1 (unfounded) - 5 (very well-founded)	4.56	0.60	18
Helpfulness for teaching integration	1 (not helpful) - 5 (very helpful)	4.40	0.61	15
Perceived complexity of the model	1 (too simple) - 5 (too complex)	3.05	0.50	20
Perceived ability to use the model	1 (not at all) - 10 (absolutely)	8.26	1.16	19
Helpfulness of the online platform	1 (not helpful) - 10 (very helpful)	9.14	0.83	14

The high mean scores indicate that participants found the model to be clear, well-founded, and a helpful tool for integrating AI competencies into their teaching. The rating for complexity (M = 3.05 on a scale from 1 to 5) suggests the model is perceived as appropriately detailed rather than overly simplistic.

Qualitative feedback further enriched these findings. Key themes that emerged were:

- **Need for practical support:** Participants strongly requested "best practice" examples, concrete application scenarios, and ready-to-use teaching materials to facilitate the model's implementation.
- **Implementation strategy:** There was discussion about whether AI competencies should be taught in a single, compulsory module or distributed across the entire curriculum. A hybrid approach was favoured.
- **Platform functionality:** Suggestions for the supporting online platform included adding AI-driven support (e.g., to help faculty find suitable competencies for their course) and functions for sharing and co-creating materials.
- **Measuring success:** Participants suggested tracking the integration of AI competencies in module descriptions during re-accreditations and conducting surveys with students, faculty, and employers.

3.4 Discussion

The results suggest that the developed model is not only theoretically sound but also practically relevant and well-accepted by its intended users, namely the academic faculty. The positive validation directly addresses the gap of insufficient content validity on the target population that Lintner (2024) identified as a common weakness in AI literacy instruments. By involving faculty in the validation process, we sought to ensure that the model's structure, terminology, and granularity meet the needs of teaching practice.

The model's core strength lies in its multidimensional structure, which synthesises the content breadth of Laupichler et al. (2023) with the application depth of Teuber et al. (2022). This integrated approach prevents a "one-size-fits-all" solution and provides a flexible framework for a heterogeneous student population with varying prior knowledge and career goals, a particularly important feature in the context of distance higher education.

Furthermore, the project goes beyond the mere creation of a model by coupling it with a practical implementation strategy centred on an interactive online platform. This platform, which curates and maps teaching materials to the model's competencies, acts as the crucial link between the abstract framework and concrete classroom activities. The workshop feedback indicated strong demand for such a support structure, highlighting that a model alone is insufficient to guarantee university-wide adoption.

While the stakeholder workshop provided strong evidence for the model's clarity and applicability, the qualitative feedback also pointed to the necessity of domain-specific adaptations. Participants discussed the extent to which specific competencies, such as "Technical Understanding", are relevant across all disciplines (e.g., social sciences versus engineering). This aligns with recent findings by Zhang et al. (2024) regarding the challenges of interdisciplinary AI education. Therefore, while the current model provides a solid university-wide framework, faculty members must still assess which of the listed competencies are relevant for the students in their respective academic disciplines.

While this study provides significant insights into the initial validation of an AI competency model for higher education, some limitations must be considered: The validation was conducted in a single workshop at one institution. While the results are promising, further research is needed to evaluate the model's applicability in different institutional contexts.

Crucially, future evaluations must extend beyond general applicability to assess the specific relevance and utilisation of the individual competencies. It remains to be verified whether educators perceive all listed competencies as meaningful and effectively integrate them into their curricula. Competencies that find little or no application in teaching practice should be critically reviewed and potentially removed to refine the model. Conversely, given the dynamic evolution of AI technologies, the framework must be continuously monitored for completeness to identify and incorporate emerging competencies that may currently be missing.

Moreover, as this study focused on validating the model's structure and utility for educators, the next step will be to empirically assess its effectiveness in fostering AI literacy among students. Future work will therefore concentrate on longitudinal studies to measure actual learning gains and on continuously updating the model to reflect these insights alongside changing labour-market demands.

4 Conclusion

The accelerating integration of Artificial Intelligence into all facets of work and society demands a proactive and structured response from HEIs. This paper has presented a comprehensive AI competency model, the AICM-HE, developed and initially validated to guide the systematic and flexible integration of AI literacy into higher education curricula.

Our model addresses the critical needs identified in current research by offering a novel, multi-dimensional framework. It synthesises established theoretical approaches (Laupichler et al., 2023; Teuber et al., 2022) into a flexible structure comprising three content sectors – Technical Understanding, Practical Application, and Critical Evaluation – and three proficiency levels – Basic AI Competencies, Professional AI Use, and AI Expert Level. This design deliberately avoids a "one-size-fits-all" approach, ensuring adaptability for a heterogeneous student body with diverse prior knowledge and career aspirations, a particularly important feature for distance higher education.

A key contribution of this work lies in its direct response to the validation gap in AI literacy assessment tools (Lintner, 2024). Through a comprehensive stakeholder workshop with academic staff from various disciplines, we obtained positive feedback regarding the model's clarity, perceived scientific foundation, and practical utility for teaching integration. This initial validation is crucial for ensuring the model's relevance and acceptance within the academic community.

Beyond the model's conceptualisation and validation, we have outlined a concrete implementation strategy centred on an interactive online platform. This platform serves as a vital bridge, connecting the abstract competency framework with practical classroom activities by curating and mapping existing teaching materials. The workshop feedback clearly indicated the high demand for such practical support, underscoring that a robust model must be accompanied by effective tools for university-wide adoption.

This study demonstrates that the proactive integration of AI literacy into higher education is a systemic challenge requiring a holistic approach. By analogy with the “Whole Institution Approach” in sustainability education (Kohl et al., 2022; Holst et al., 2024), effectively embedding AI literacy necessitates a strategic engagement across all dimensions of an institution – from curriculum design and pedagogical support to quality assurance and continuous development. The presented

competency model and its initial validation represent a crucial, but singular, component of this broader institutional transformation.

Recognising that a competency model is a snapshot in time, particularly in the rapidly evolving field of AI, its continuous development and evaluation are paramount. Future research will focus on expanding the model's empirical validation in diverse institutional contexts. Specifically, it is necessary to assess the domain-specific relevance of individual competencies to determine, for example, how technical depth requirements differ between social sciences and engineering. Furthermore, the mapping of these competencies to specific teaching blocks and degree levels (Bachelor vs. Master) needs to be verified in practice to ensure the model's effectiveness across the entire curriculum. Also, longitudinal studies are needed to assess the effectiveness of our approach to promoting AI competence among students. The interdisciplinary and stakeholder-driven approach employed in this study has proven effective and should guide future iterations. Standardised and validated assessment instruments, developed with continuous input from students and educators, will be essential for measuring learning gains and adapting the model to reflect the dynamic demands of the AI-driven future.

In conclusion, this paper provides a valuable blueprint for HEIs navigating the complexities of AI integration. By combining theoretical rigour with practical validation and a clear implementation strategy, we demonstrate how to transform the general call for AI literacy into a structured, university-wide educational initiative. This ensures that graduates are not merely passive users of AI technologies, but become competent, critical, and responsible contributors to the responsible shaping of an AI-driven future.

Acknowledgement

- **Conflict of interest:** The authors declare that they have no conflicts of interest.
- **Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.
- **Research ethics:** This study did not require ethical approval as it involved voluntary feedback from professional staff on an educational model.

References

Allen, L. K., & Kendeou, P. (2024). ED-AI Lit: An Interdisciplinary Framework for AI Literacy in Education. *Policy Insights from the Behavioral and Brain Sciences, 11*(1), 3–10. https://doi.org/10.1177/23727322231220339

Almatrafi, O., Johri, A., & Lee, H. (2024). A systematic review of AI literacy conceptualization, constructs, and implementation and assessment efforts (2019–2023). *Computers and Education Open, 6,* 100173. https://doi.org/10.1016/j.caeo.2024.100173

Bobula, M. (2024). Generative artificial intelligence (AI) in higher education: a comprehensive review of challenges, opportunities, and implications. *Journal of Learning Development in Higher Education, 30*. https://doi.org/10.47408/jldhe.vi30.1137

Cox, A. (2024). Algorithmic Literacy, AI Literacy and Responsible Generative AI Literacy. *Journal of Web Librarianship, 18*(3), 93–110. https://doi.org/10.1080/19322909.2024.2395341

Ehlers, U.-D. (2023). Future Skills Framework. Kompetenzen für die KI-Welt. *managerSeminare, 305*, 70–77.

Holst, J., Grund, J. & Brock, A. (2024). Whole Institution Approach: measurable and highly effective in empowering learners and educators for sustainability. *Sustainability Science, 19*(4), 1359–1376. https://doi.org/10.1007/s11625-024-01506-5

Kohl, K., Hopkins, C., Barth, M., Michelsen, G., Dlouhá, J., Razak, D. A., Bin Sanusi, Z. A. & Toman, I. (2022). A whole-institution approach towards sustainability: a crucial aspect of higher education's individual and collective engagement with the SDGs and beyond. *International Journal of Sustainability in Higher Education, 23*(2), 218–236. https://doi.org/10.1108/IJSHE-10-2020-0398

Laupichler, M. C., Aster, A., Haverkamp, N., & Raupach, T. (2023). Development of the "Scale for the assessment of non-experts' AI literacy" An exploratory factor analysis. *Computers in Human Behavior Reports, 12,* 100338. https://doi.org/10.1016/j.chbr.2023.100338

Lintner, T. (2024). A systematic review of AI literacy scales. *npj science of learning, 9*(50). https://doi.org/10.1038/s41539-024-00264-4

Long, D., & Magerko, B. (2020, 25.–30. April). *What is AI Literacy? Competencies and Design Considerations*. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, Honolulu, HI, USA (pp. 1–16). https://doi.org/10.1145/3313831.3376727

Mokkink, L. B., Terwee, C. B., Patrick, D. L., Alonso, J., Stratford, P. W., Knol, D. L., Bouter, L. M. & de Vet, H. C. W. (2010). The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: An international Delphi study. *Quality of Life Research, 19*(4), 539–549. https://doi.org/10.1007/s11136-010-9606-8

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence, 2*, 100041. https://doi.org/10.1016/j.caeai.2021.100041

OECD. (2023). *OECD Employment Outlook 2023: Artificial Intelligence and the Labour Market.* OECD Publishing. https://doi.org/10.1787/08785bba-en

Southworth, J., Migliaccio, K., Glover, J., Glover, J. N., Reed, D., McCarty, C., Brendemuhl, J., & Thomas, A. (2023). Developing a model for AI Across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers and Education: Artificial Intelligence, 4*, 100127. https://doi.org/10.1016/j.caeai.2023.100127

Teuber, K., Dindarian, A., & Ekaterina, N. Cv. N. (2022). Künstliche Intelligenz und ihre Anforderungen an den Kompetenzerwerb [Artificial intelligence and its requirements for competence acquisition]. In R. Knackstedt, J. Sander, & J. Kolomitchouk (Hrsg.), Kompetenzmodelle für den Digitalen Wandel. Orientierungshilfen und Anwendungsbeispiele (S. 99–115). Springer. https://doi.org/10.1007/978-3-662-63673-2_5

Zhang, C. X., Rice, R. E., & Wang, L. H. (2024). College students' literacy, ChatGPT activities, educational outcomes, and trust from a digital divide perspective. *New Media & Society, 28*(2), 673-695. https://doi.org/10.1177/14614448241301741

European Scientific Journal for Dual Higher Education

Vol. 2, No. 2 (2026)
ISSN (online): 3052-7015

INSTITUTIONAL TRANSLATION, ORGANISATIONAL IDENTITY AND AI IN GERMAN HIGHER EDUCATION

Stephanie Ashford [1*]

[1] *Baden-Wuerttemberg Cooperative State University (DHBW), Germany*

Keywords:
Dual higher education
Institutional translation
Organisational identity
Machine translation post-editing
Internationalisation

Article history:
Received: 31 December 2025
Revised: 2 March 2026
Accepted: 3 March 2026

To cite this article:
Ashford, S. (2026). Institutional Translation, Organisational Identity and AI in German Higher Education. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), 67-81. https://doi.org/10.82321/07MA-34M66

Abstract
As European universities intensify their internationalisation efforts, AI-assisted translation increasingly shapes institutional communication. Yet translating a university is not a neutral transfer of information but an act of institutional positioning. This qualitative case study investigates how neural machine translation (NMT) and large language models (LLMs) influence institutional self-representation in a German dual higher education institution. Comparing human and AI-mediated workflows across lexical, textual and institutional levels, the findings show that NMT narrows culturally specific terminology into dominant Anglophone categories, while LLMs produce greater fluency but default to statistically prevalent norms unless guided through informed prompting. In human-in-the-loop workflows, prompting emerges as a strategic competence through which translators shape institutional voice and mitigate convergence pressures. AI-assisted translation thus constitutes a strategic governance issue rather than a merely technical tool.

1 Introduction

1.1 Aim and scope

English has become the *lingua franca* of higher education, influencing research dissemination, international rankings, and cross-border academic collaboration (Ammon 2012; Vera-Baceta et al., 2019). Its role now extends beyond research and teaching to administration, marketing, and strategic communication, where English is used to signal international orientation, competitiveness and institutional legitimacy (Lawrence, 2007).

As universities intensify their internationalisation efforts, an increasing number of institutional texts – including legal statutes, programme descriptions, diploma supplements, and marketing materials – are being translated into English. These texts are not purely informational; they influence how institutions are categorised, compared, and valued by external audiences, and also shape internal perceptions of institutional purpose and identity.

Traditionally, such high-stakes translations were carried out by human translators, ideally with specialised knowledge of institutional contexts. However, universities are increasingly adopting artificial intelligence (AI)-assisted translation as a fast, cost-saving alternative. This paper argues that this efficiency-driven perspective overlooks the strategic consequences of different translation technologies and underestimates the role of human translators as mediators of institutional meaning.

* Corresponding author.
E-mail address: stephanie.ashford@dhbw.de

Drawing on research in institutional translation, organisational identity, and higher education internationalisation, this paper presents a qualitative case study of a German university operating within a dual higher education model. It examines how human and AI-mediated translation choices affect institutional self-representation at lexical, textual, and institutional levels. The study has three primary aims: (1) to conceptualise institutional translation as a strategic practice; (2) to analyse how AI-mediated translation alters translation outcomes across different levels of analysis; and (3) to assess the broader implications for universities in non-Anglophone contexts.

Adopting a constructivist perspective, this paper focuses on identity work rather than treating organisational identity as a fixed attribute. References to organisational identity are therefore used as shorthand for practices of institutional self-representation, enacted through language and translation.

The following section outlines the theoretical framework employed in this study. This framework integrates three key areas: institutional theory, organisational identity, and translation studies. Such an approach allows us to analyse the deeper consequences for how universities present themselves to international audiences, rather than simply describing terminological choices.

1.2 Challenges in translating institutional texts

Administrative, legal, promotional, and strategic institutional texts constitute the corpus of organisational self-representation, providing empirical evidence of identity claims and aspirations. For universities seeking to operate bilingually, translating this corpus can be viewed as a means of 'cloning' the institution in a second language. In this process, the institution's structures, roles and values are rearticulated for international audiences embedded in different academic traditions and cultures (Ashford, 2019).

In such contexts, translation is rarely a neutral transfer of meaning. In highly institutionalised settings, such as universities, titles, roles and functions carry substantial symbolic and legal weight. German higher education terms such as *Kanzler, Rektor, Fakultät, Lehrstuhl, Präsidium, wissenschaftliche/r Mitarbeiter/in,* and *Duales Studium* are rooted in specific governance structures and academic traditions, and therefore lack direct equivalents in English.

Such terms are difficult to translate for two main reasons: systemic non-equivalence, where practices may only exist in German-speaking academic contexts (e.g., *Habilitation, Beamtenrecht, Berufungsleistungsbezüge*), and cultural-cognitive gaps where concepts are context-specific or tied to intellectual traditions that may be unfamiliar to international audiences (e.g., *Willkommenskultur, Humboldtsches Bildungsideal*).

Other challenges include false cognates (e.g., *Kanzler*-chancellor, *Promotion*-promotion) and the broad semantic scope of some German terms. The term Hochschule, for instance, is not only a false cognate with 'high school', but also encompasses a variety of tertiary education institutions regulated under German higher education law (Behmel & Neudorfer, 2016; Siepmann, 2016).

A similar example is *wissenschaftliche/r Mitarbeiter/in*, an umbrella term covering a wide range of academic roles. As shown in Table 1, selecting an appropriate English equivalent depends on institutional context, requiring detailed knowledge of both source and target systems, and of communicative intent.

Table 1. Translations of Wissenschaftliche/r Mitarbeiter/in

German term	*Typical situation*	*Possible English translations*
Doctorand/in als Mitarbeiter/in	PhD/doctoral student employed by university, doing research or teaching while writing dissertation/thesis	Doctoral Researcher, Research Assistant, PhD Candidate
Postdoc (nach der Promotion, befristet angestellt)	Conducting independent or team research, sometimes teaching	Postdoctoral Researcher, Research Fellow, Research Associate
Akademischer Mittelbau allgemein	Classic *Mittelbau* role, not tenure track	Academic staff member, Lecturer (UK), Teaching and research Associate

Table 1. Translations of Wissenschaftliche/r Mitarbeiter/in (continued)

German term	*Typical situation*	*Possible English translations*
Lehrkraft für besondere Aufgaben	Primarily teaching, often contract-based	Teaching Fellow, Lecturer (UK), Adjunct Instructor (US)
Doctorand/in als Mitarbeiter/in	PhD/doctoral student employed by university, doing research or teaching while writing dissertation/thesis	Doctoral Researcher, Research Assistant, PhD Candidate
Postdoc (nach der Promotion, befristet angestellt)	Conducting independent or team research, sometimes teaching	Postdoctoral Researcher, Research Fellow, Research Associate
Akademischer Mittelbau allgemein	Classic *Mittelbau* role, not tenure track	Academic staff member, Lecturer (UK), Teaching and research Associate
Lehrkraft für besondere Aufgaben	Primarily teaching, often contract-based	Teaching Fellow, Lecturer (UK), Adjunct Instructor (US)
Wissenschaftliche/r Mitarbeiter/in mit Projektstelle	Fixed-term contracts on grants	Research Associate, Project Researcher, Research Assistant
Senior Mitarbeiter/in (langjährig, ohne Professur)	Experienced, non-professorial academic with both teaching and research duties	Senior Research Fellow, Senior Lecturer (UK), Adjunct Faculty (US, if part-time teaching focus)

Author's own representation

Without an explicit language policy, such interpretive decisions are often based on individual preferences, which is likely to lead to inconsistencies in texts and disputes over meaning. Frequently contested terms can become "translation flashpoints" that reveal underlying power struggles, disputes over legitimacy, and identity conflicts (Ashford, 2021).

Universities operating within a dual higher education model face additional challenges when seeking to balance vocational and academic logics. This can affect linguistic choices in both the source texts and their translations, as shown in Table 2. Translation thus becomes a catalyst for renegotiating identity aspirations and competitive positioning.

Table 2. Competing logics in organisational culture and terminology choices

Logic	*Professional orientation*	*Academic orientation*
Identity focus	Pioneering, innovative, modern, cutting-edge	Conventional, rooted in tradition, 'tried and tested'
Accessibility	Inclusive, accessible, open	Exclusive, selective, elite
Curriculum	Interdisciplinary, broad, focus on employability	Specialised fields, narrow scope, depth over breadth
Core mission	Teaching-oriented and vocationally competitive	Research-oriented and academically competitive
Structure	Flat organisation with lean management	Hierarchical structure (e.g., with *Mittelbau*)
Language policy	English as primary or secondary institutional language	German as the official language (*Amtssprache*)
Terminology (examples)	School of Engineering	Faculty of Engineering
	Steering/Executive Committee	Presidency, *Präsidium*
	Head of Administration	Provost, Registrar
	Head of Department	Dean
	Former students	*Alumni*
	Exam supervisor	Invigilator (BE), Proctor (AE)
	Head of Internationalisation	Vice-chancellor for Internationalisation

Table 2. Competing logics in organisational culture and terminology choices (continued)

Logic	*Professional orientation*	*Academic orientation*
Terminology (examples)	Class	Seminar

Author's own representation

Despite its strategic importance, institutional translation is often handled in fragmented and ad hoc ways. In the absence of translation governance, there is a risk of texts being translated by non-specialists or automated systems, often in combination, which can have significant consequences for consistency, credibility, and institutional distinctiveness.

1.3 Strategic use of translation

Organisations seeking legitimacy may engage in symbolic compliance with dominant norms when substantive change is constrained, a phenomenon described as "decoupling" (Meyer & Rowan, 1977). In higher education, translation can be used as camouflage to hide local realities and appear to meet global expectations, in effect acting as a form of linguistic window-dressing. For example, German institutions such as *Fachhochschulen*, *Hochschulen für angewandte Wissenschaften* and *Duale Hochschulen* are legally prohibited from using the term *Universität*, yet they often adopt the term "University" in their English branding (e.g., Frankfurt University of Applied Sciences and Hochschule Furtwangen University). Some older universities omit historical figures from their English names for international audiences, while retaining them for their German-speaking audiences (e.g., University of Heidelberg/Ruprecht-Karls-Universität Heidelberg).

Similarly, degree programmes and courses taught in German are often given English titles to signal internationality or prestige (Ashford, 2019).

1.4 Translation as a driver of institutional isomorphism

In institutional theory, isomorphism refers to the process whereby organisations in the same field begin to look and act like one another in response to legitimacy pressures (DiMaggio & Powell, 1983). For a German university, this may involve emulating prestigious institutions in the Anglophone world to appear more international and competitive. Translation practices have the potential to reinforce this process. For example, professional networks of university translators, shared style guides, and standardised terminology promote a generic English register that smooths over national and organisational specificity (Ashford, 2019).

While experienced university translators may seek to preserve the markers and nuances of national, organisational and cultural distinctiveness, efficiency pressures frequently override such efforts. Translation therefore not only reflects institutional isomorphism but also contributes to it.

1.5 GenAI as a new actor in translation

The rise of generative AI (GenAI) has intensified these dynamics. Translation technologies now encompass neural machine translation (NMT) systems such as DeepL and Google Translate, and large language models (LLMs) such as ChatGPT, Gemini and Copilot, which users can prompt to generate translations across registers and styles. Although these tools offer greater speed and fluency, research highlights risks relating to reliability, bias, data protection, accountability (do Carmo, 2025a; Nunes Vieira, 2024; Ottmann & Canfora, 2021). Unlike human translators, or indeed the institutions they work for, providers of AI-tools bear no professional liability for errors in legal or administrative documents.

Studies in higher education contexts (Gimpel et al., 2023; Büttner, 2025; Crain, 2025; Cuniffe, 2025; Fleisig et al., 2024) further show that GenAI systems tend to favour American English, default to statistically dominant equivalents, exhibit prestige-bias, and sometimes translate too freely or even 'hallucinate', thereby risking institutional misrepresentation. Recognising these limitations, professional university translators emphasise the need for post-editing (human refinement of the

machine-translated text) to achieve professional-level quality (LKS, 2025). As Crain (2025) points out, “Humans use language creatively – so they can bridge gaps, read words that are not there, and skip words that are not needed”.

Against this backdrop, this study investigates how GenAI shapes institutional translation practices in a concrete higher education setting.

1.6 Research questions

The emergence of GenAI as a new actor in institutional translation raises questions about quality, standardisation, identity, and the balance between global visibility and local authenticity. This study addresses the following research questions:

1. How does GenAI-mediated translation affect institutional branding and positioning?
2. What benefits, limitations, and risks emerge when GenAI is compared with human translation?
3. To what extent does GenAI reinforce isomorphic tendencies in institutional self-representation?
4. To what extent can the findings be transferred to other universities in non-Anglophone contexts?

2 Methodology

2.1 Research design

This study employs a qualitative comparative case study design to investigate how different AI-assisted translation workflows shape institutional self-representation. A case study approach is appropriate because the research questions focus on meaning-making, identity construction, and institutional positioning, rather than on frequency effects or large-scale linguistic patterns.

The Duale Hochschule Baden-Württemberg (DHBW) was selected as the case institution due to its legally distinctive hybrid organisational structure, strong regional embeddedness, and evolving internationalisation strategy. As Germany’s first public university specialising in vocationally-integrated degree programmes, it combines academic education with paid, employer-based workplace training, which builds on the German apprenticeship tradition. With several campuses across the federal state of Baden-Württemberg, the DHBW operates under a unified central governance structure, while its campuses maintain close cooperation with regional employers and exercise a degree of local autonomy. This decentralised configuration creates potential tensions between local flexibility and the need for consistent, university-wide coordination.

Higher education governance in Germany falls under the authority of the federal states (*Länder*). In November 2024, an amendment to the state higher education law (*Landeshochschulgesetz*) introduced wide-ranging structural reforms at the DHBW, including the formal establishment of faculties. These reforms place the institution in an ambiguous and analytically revealing position between academic and vocational education.

At the same time, the DHBW is pursuing an internationalisation strategy that includes expanding its English-language programmes to attract degree-seeking students from abroad, and promoting its model as internationally transferable. This generates substantial translation challenges as core elements of DHBW’s organisational identity do not align neatly with dominant higher education categories in English-speaking contexts.

Identity construction at the DHBW involves navigating three dualities: (1) academic versus vocational orientation, (2) local autonomy versus central governance, and (3) regional embeddedness versus international positioning. These characteristics make the institution particularly suitable for examining the strategic consequences of AI-mediated translation.

The Baden-Württemberg context is also analytically significant. The state hosts a well-established network of professional university translators. The *State Coordination Office for Translations Relating to Higher Education in Baden-Württemberg* (LKS), based at the University of Mannheim, provides translation services, training, and support for universities with the language

CC BY NC

aspects of their internationalisation strategy, and maintains a network of university translators extending across the DACH region (Germany, Austria, Switzerland). Comparable centres in Bavaria (*BaySev*) and Mecklenburg-Vorpommern (*Zentrale Übersetzerstelle*) reflect a broader trend towards the institutionalisation and standardisation of English translation in German higher education.

The aim of this case study is thus to shed light on how AI-translation mediates institutional self-representation in non-Anglophone higher education systems, particularly those characterised by hybrid organisational models.

2.2 Data selection and corpus

The analysis draws on a corpus of institutional documents that include one complete diploma supplement (Bachelor's degree in Business Administration), webpages from the university's central website, and webpages from nine satellite campuses. All source texts were originally drafted in German. The translated versions of the webpages were publicly accessible between January and December 2025. For the purposes of comparison, selected extracts were retranslated under controlled conditions using neural machine translation (NMT) and large language model (LLM) systems.

Texts were selected according to three criteria:

1. Strategic relevance for external stakeholders: The document had to function as an interface with external stakeholders such as accreditation bodies, international students, or partner institutions.
2. Identity-critical terminology: The text needed to contain terms central to institutional self-definition (e.g., *Duale Hochschule*, *wissenschaftlich*, *Dualer Partner*).
3. Availability of source and target texts: Both the German original and an existing English translation had to be accessible for comparison.

The focus on diploma supplements and institutional webpages reflects their dual legal and promotional function. These genres combine regulatory precision with branding, making them particularly sensitive sites to translation choices that influence institutional positioning.

In addition, the online translation tool Linguee was used to research how the university name is rendered in English. Linguee provides examples of terms in actual translated texts, including official documents, thus offering contextualised usage and translation memory data.

2.3 Comparative translation framework

The study compares four translation approaches applied to German source texts in order to evaluate the effects of different forms of human and AI-mediated translation:

1. Neural Machine Translation (NMT): Unprompted output generated by standard NMT tools, representing an instrumental view of AI as a fast, low-cost substitute for human translation.
2. Human post-editing: A version revised by a professional translator with specialised knowledge of higher education systems and institutional conventions.
3. Baseline LLM translation: Output generated with minimal prompting to assess default equivalence, semantic narrowing, and prestige bias.
4. Human-guided LLM translation: A context-sensitive workflow in which the translator acts as a strategic prompter, supplying institutional knowledge, terminological preferences, register specifications, and communicative intent.

This framework enables comparison not only between translation systems, but also between degrees of human mediation, allowing analysis of how translator agency shapes translation outcomes.

2.4 AI use in manuscript

For this study, NMT and LLM tools were used to produce comparative translations of selected German source texts. During the preparation of the manuscript, AI tools were used sparingly and transparently to improve clarity and assist with structural revision. They were not used for data generation, analysis, or interpretation. The author remains responsible for all analytical decisions and final formulations.

References to "AI" in this paper ("AI-mediated", "AI-assisted", etc.) refer to both NMT and LLM systems. However, it is important to note that generative AI (GenAI) translations are only a feature of the latter. Although this paper uses British English spelling, NMT and LLM outputs reproduced in the tables reflect those systems' default settings, which typically favour American English.

2.5 Analytical procedure

The analysis proceeded in three stages:

1. Comparative alignment: German source passages were aligned with NMT output, baseline LLM translations, human post-edited versions, and human-guided LLM outputs using a structured comparison matrix.
2. Identification of translation shifts: Instances of semantic narrowing, register shift, terminological substitution, prestige alignment, and voice inconsistency were identified through close reading. Analytical categories were deduced from the theoretical framework (institutional translation, isomorphism, identity work) and refined inductively during analysis.
3. Institutional interpretation: Linguistic shifts were interpreted in light of institutional theory, particularly isomorphism and identity work.

Coding was conducted manually by the author. Throughout the analysis, particular attention is paid to the 'human variable': instances where professional translators modify, override or strategically guide AI-generated output based on linguistic expertise and awareness of institutional context, thereby mitigating homogenising effects or improving the translation in other ways.

3 Results and discussion

This section presents the findings from the comparative analysis and interprets how AI-assisted translation influences institutional self-representation. Rather than separating results from discussion, the analysis integrates empirical comparison with theoretical interpretation. Effects emerge at three interconnected levels: lexical, textual, and institutional.

3.1 Lexical-level effects: Semantic narrowing and default equivalence

At the lexical level, the most consistent pattern is semantic narrowing, which appears more pronounced in NMT output than in LLM systems. The contrast is not simply between 'good' and 'bad' translation, but between fixed statistical equivalence and interactive contextual mediation.

A clear example of this can be seen in the translation of *wissenschaftlich* in the diploma supplement. In German higher education discourse, *wissenschaftlich* refers broadly to research-based academic work rather than to a specific disciplinary field (e.g., the natural sciences, political science). As shown in Table 3, NMT translates *wissenschaftlich* as "scientific", thereby narrowing its meaning and implicitly situating the degree qualification within a more restricted epistemic domain. This shift may affect how the qualification is viewed in terms of employability, accreditation, and international recognition.

In the human post-edited version, the passage is reformulated to emphasise research competence and the application of theory. Baseline LLM output offers alternatives such as "academic work" and "evidence-based methods". When prompted, it can adjust the tone and emphasis (e. g. "Formal & Academic", "Professional & Concise"), as well as providing alternative translations tailored to a specific discipline.

Table 3. Translating 'wissenschaftlich'

Source text	*NMT*	*Post-edited (human)*	*LLM*
Die Absolventinnen und Absolventen sind befähigt, selbstständig **wissenschaftlich** zu arbeiten und **wissenschaftliche** Ergebnisse in der betrieblichen Praxis zur Anwendung zu bringen bzw. auf der Basis **wissenschaftlicher** Erkenntnisse und Methoden auch komplexe Probleme …	Graduates are able to work independently in **science** and to apply **scientific** results in business practice or to solve complex problems in business practice on the basis of **scientific** knowledge and methods.	Graduates are also able to conduct **research** independently and apply the **theories, concepts and methods** acquired during their studies to the task of solving complex problems in the workplace.	Graduates are qualified to conduct **independent academic work** and to apply **research findings** in professional practice, as well as to solve complex problems using **evidence-based methods and insights**…"

Author's own representation

Notably, the LLM provides unsolicited meta-linguistic commentary, offering context-sensitive translations of "*wissenschaftliche Erkenntnisse*" such as "scientific findings", "academic insights" and "evidence-based knowledge", and explaining that "scientific" may conjure up images of laboratory-based research for English-speaking audiences. It also provides vocabulary breakdowns of key terms such as *Absolventinnen* und *Absolventen*, and offers advice on language usage, such as recommending "professional practice" for *betrieblichen Praxis*.

These patterns support the broader finding that LLMs offer greater fluency and stylistic polish than earlier NMT systems. They also demonstrate the interactive potential of LLMs, which can function as language tutors when guided through informed prompts.

Overall, the findings confirm that lexical choices act as positioning devices in institutional texts. When statistically dominant equivalents replace context-rich terminology, institutional meaning becomes compressed into globally recognisable, yet potentially misleading categories. LLM systems mitigate these effects by enabling variation, but only when human translators intervene strategically.

In summary, AI-mediated translation at the lexical level shapes how academic work is conceptualised and valued across systems. NMT tends towards semantic narrowing, whereas LLM systems allow contextual differentiation. The preservation of institutional meaning relies on human interpretive guidance.

3.2 Lexical-level effects: Semantic narrowing and default equivalence

At the textual level, AI-assisted translation can affect coherence, register, and ultimately institutional voice. In one diploma supplement extract (Table 4) the German pronoun *sie* is translated inconsistently as both *you* and *they*, despite there being a clear referent in the source text. Switching between impersonal description and direct address disrupts coherence and is likely to confuse readers. While this can be easily corrected through human post-editing, such instability illustrates how institutional voice can fragment in AI-assisted workflows.

LLM output does not exhibit this confusion of pronouns. As Reager (2024) observes, LLMs are less susceptible to such errors than NMT tools because they process larger textual units rather than isolated sentences, thereby retaining a more extensive translation memory.

Table 4. LLMs less likely to confuse personal pronouns (example)

Source text	*NMT*	*Post-edited (human)*	*LLM*
Sie können zielgerichtet und erfolgreich in Teams agieren und diese leiten. Auch schwierige Kommunikationsaufgaben im Unternehmen und mit der Unternehmensumwelt können selbstständig durchgeführt werden.	**You** will be able to act purposefully and successfully in teams and lead them. **They** can also perform difficult communication tasks within the company and with the corporate environment independently.	**They** are able to collaborate in and lead teams effectively, which allows **them** to navigate complex communication challenges both within the organisation and in external interactions.	**They** are able to work purposefully and successfully in teams and to lead them. Even challenging communication tasks within the organization and with its external environment can be carried out independently.

Author's own representation

However, both NMT and LLM systems reproduce errors, redundancies and stylistic weaknesses present in the source text, illustrating the 'garbage in, garbage out' effect. In the example shown in Table 5, the machine output mirrors a tautological formulation of the original German text. The human post-edited version resolves the issue only after clarification with the author, who acknowledges the tautology and explains that the intended meaning concerns subject knowledge complemented by practical work experience.

Table 5. Flawed input = flawed output (example)

Source text	*NMT*	*Post-edited (human)*	*LLM*
Die Absolventinnen und Absolventen zeichnen sich dadurch aus, dass sie über ein solides und breites betriebswirtschaftliches Basiswissen und über eine gute wirtschaftsbezogene Allgemeinbildung verfügen	Graduates stand out because they have a solid and broad basic knowledge of business administration and a good business-related general education.	Graduates with this degree not only have a firm understanding of the fundamentals of business administration, but also knowledge and skills acquired through experience of working in the field.	Graduates possess a solid and comprehensive foundation in business administration, complemented by a broad general education in economics.

Author's own representation

This example shows how a human translator can intervene to produce a text that conveys the intended meaning, in this case by clarifying an ambiguity with the author of the source text. It reinforces the point made in Section 3.1 that, when institutional meaning is at stake, AI output remains dependent on the interpretative and editorial work of human translators.

In summary, LLMs outperform NMT in terms of contextual coherence, yet neither compensates for ambiguities or weaknesses in the source text. Institutional voice remains vulnerable in AI-assisted workflows and requires human mediation to ensure consistency, clarity and credibility are maintained.

3.3 Institutional-level effects: naming, categorisation, and prestige bias

The most significant effects of translation appear at the institutional level, particularly with regard to naming and categorisation.

Analysis of publicly available translations of *Duale Hochschule* reveals considerable variation ranging from "Cooperative State University" to "dual university", "vocational college" and "technical college". Examples collected from Linguee (Figure 1) are listed here in alphabetical order.

Baden-Wuerttemberg Cooperative State University – Baden-Württemberg Cooperative State University – Baden-Württemberg University – berufsakademie – Cooperative State University Baden-Württemberg – corporate state university – dual academy – dual university – Dual University Baden-Württemberg – duale hochschule baden württemberg – occupational training school – technical college – university of cooperative education –vocational college

Figure 1. Translations of "Duale Hochschule" in English (Linguee 2025)

This variety suggests not only terminological instability but also uncertainty regarding international categorisation. For many years, the university's English webpages referred to the institution as "Baden-Württemberg Cooperative State University (DHBW)" and also used variations such as "University of Cooperative Education". Since 2025, the English name seems to have disappeared from the university's central website, where the abbreviation DHBW is used instead. No official public statement has been given for this change, and the English name continues to be used in websites of the satellite campuses.

Comparative LLM translations of the mission statement (Table 6) demonstrate consistency in the use of the official name, but variation in translating *Berufsakademie*, the institution's legal predecessor. One system retains the German term, thereby avoiding miscategorisation, while others render it as "Cooperative Education institution" or "Vocational Academy". This may evoke associations with lower-status institutions in English-speaking contexts despite the pioneering role of the *Berufsakademie* in delivering degree-level professional education.

Table 6. Comparing LLM translations of the institution's name

German original	*ChatGPT*	*Gemini*	*Co-pilot*
Die Duale Hochschule Baden-Württemberg (DHBW) geht aus der Berufsakademie Baden-Württemberg hervor und führt das seit mehreren Jahrzehnten bewährte Erfolgsmodell des Theorie und Praxis integrierenden dualen Studiums in der Hochschullandschaft fort.	The Baden-Württemberg Cooperative State University (DHBW) emerged from the Baden-Württemberg Cooperative Education institution and continues the successful model of dual study programs that integrate theory and practice, a model that has proven its value over several decades, within the higher education landscape.	The Baden-Württemberg Cooperative State University (DHBW) evolved from the Berufsakademie Baden-Württemberg and continues the proven, decades-long success model of dual education—which integrates theory and practice—within the higher education landscape.	The Baden-Württemberg Cooperative State University (DHBW) emerged from the Baden-Württemberg Vocational Academy and continues the successful model—proven over several decades—of dual study programs that integrate theory and practice within the higher education landscape.

Author's own representation

As expected, the LLM outputs reflect the system's default settings, which typically favour American English ("program" instead of "programme") and the typographic convention of closed em dashes rather than spaced en dashes.

Across AI tools, *Hochschule* is consistently translated using variants containing "university", reflecting both semantic narrowing and prestige bias. These choices align the institution with dominant Anglo-American templates, thereby reinforcing isomorphism.

An analysis of course offers confirms the practice of marketing German-taught degree programmes under English labels, many of which include 'management' (e.g., Supply Chain Management, Industrial Management, Digital Business Management, Technical Management, and Risk and Insurance Management). This reflects the perception of programme heads that German equivalents such as *Leitung* and *Verwaltung* are "too narrow" or "unappealing" (Ashford 2019).

Further variation appears across satellite campuses in the translation of identity-critical terms such as *Dualer Partner*, *Duales Studium*, and *Studiengang* (Table 7).

Table 7. Variation in translation choices across satellite campuses

German	*English translations*
(Studiengang) Industrie	Industrial Management, Management in Industry
Assistenz Rektorat	secretary to the president
Dekan/Dekanin	Dean, vice president
Duale Hochschule	DHBW, Cooperative State University, University of Applied Sciences
Dualer Partner	cooperative partner, training company, partner company, corporate partner, dual partner, corporate partner company, cooperative partner, workplace training provider
Duales Studium	cooperative education, dual education, dual course of study, career-integrated degree course, career-integrated study, dual study system, job-integrated learning (JIL)
Fakultät Wirtschaft	School of Business, Business Faculty, Faculty of Business
Lehrbeauftragte	guest lecturer, presentation speaker, external lecturer, associate lecturer, highly qualified specialists from partner companies and social institutions
Präsidium	President's Office, Präsidium, DHBW headquarters, main seat
Rektorat	Presidents Office, President's office, rectorate, Rektorat, rector's office
Standort	location, campus, branch campus, satellite site
Studiengang	study programme, study program, degree program, degree course, course of studies
Studiengangsleiter/ Studiengangsleiterin	Head of Department, programme director, program director

Author's own representation

While many translations are linguistically sound, the wide range of options suggests an absence of coordinated terminology governance. Some choices risk misinterpretation. For instance, "training company" implies a business organisation that specialises in training rather than an employer, whereas "workplace training provider" could suggest an organisation that provides unpaid placements, despite the fact that DHBW students receive a salary. Inconsistencies between British and American English (e.g., centre/centre, internationalisation/internationalization, program/ programme, labor/labour) even occur within individual webpages, which could indicate decentralised authorship, individual preferences, or an absence of an explicit language policy.

The English-language webpages are not usually direct translations of the German originals, but rather are versions that have been tailored for an international audience. Compared with the main website, satellite campus pages exhibit more frequent errors in spelling, grammar, word choice, and orthography, indicating that many were produced or translated by non-specialists.

Some errors reflect native speaker tendencies (e.g., "accomodaton" instead of "accommodation"), while others reflect transfer from the writer's first language (L1). One example is the overuse of exclamation marks, such as "Our classes have a maximum of 35 students!", "You will have close contact with the teaching staff!", "After your arrival we provide academic and non-academic support"!", and "Travel insurance is not sufficient for studying in Germany!". These carry different degree of emphasis in English and can undermine credibility in formal contexts.

Overall, it seems that webpages are produced locally rather than being coordinated centrally. The variation across campuses reflects the absence of institution-wide language governance and decentralised translation practice.

In summary, translation choices at the institutional level influence categorisation, prestige alignment, and perceived equivalence within global higher education. Variation in translation tools and practices across campuses reveals decentralised governance and highlights translation as a mechanism through which pressures for institutional convergence or divergence are enacted rather than merely reflected.

3.4 Translation, institutional isomorphism, and organisational flux

The findings suggest that machine translation acts as an active driver of institutional isomorphism. NMT systems tend to produce fluent, yet bland and generic, English texts. LLM systems enable more contextual differentiation but still rely on historically dominant patterns unless guided by informed prompting.

However, universities are not static entities. They are complex, hybrid organisations that combine academic, bureaucratic, professional and market logics, and they undergo frequent reform (de Boer et al, 2007; Hüther & Krücken, 2010; Kleimann, 2019). In such conditions, institutional terminology evolves. Translating a university is therefore an ongoing process that requires continual renegotiation as practices, hierarchies, and identities shift. AI systems trained on past usage patterns are poorly equipped to reflect such shifts without human oversight.

Emerging European AI regulation further highlights the importance of human oversight in institutional translation, particularly to mitigate risks such as hallucinations and cultural or semantic distortion.

The changing role of professional translators is also relevant. As universities expand their presence in English, the demand for translation continues to grow, but at the same time the nature of translators' work is shifting. They are increasingly asked to post-edit AI-generated output, which requires critical evaluation, terminological judgement, and institutional knowledge (Do Carmo & Moorkens, 2020; Crain, 2025). However, this shift is often accompanied by declining remuneration, reduced professional recognition, limited scope for interpretive agency, ultimately resulting in reduced work satisfaction. As Do Carmo (2025b) argues, post-editing is frequently framed as a menial, corrective "mopping up" task, despite involving linguistic expertise.

Paradoxically, although AI offers the promise of efficiency, the uncritical adoption of AI could accelerate the homogenisation of institutions at a time when they are seeking to establish their own unique identities in an increasingly competitive higher education landscape.

4 Conclusions

The study examined how AI-assisted translation influences the way a German dual higher education institution represents itself. By comparing neural machine translation (NMT), large language models (LLMs), and human-mediated workflows, the analysis revealed that AI systems play a more active role than simply accelerating translation processes. They also contribute to the construction, stabilisation and, in some cases, distortion of institutional meaning. At lexical, textual and institutional levels, translation emerges as a strategic practice embedded in governance, identity work, and institutional positioning.

4.1 Lexical choices, semantic narrowing and conceptual clarity (RQ1)

At the lexical level, AI-mediated translation affects institutional positioning through semantic narrowing and default equivalence. NMT systems in particular tend to select the statistically dominant English equivalents for culturally embedded German terms. While this could enhance international recognition, it compresses context-rich concepts into globally standardised categories, which can obscure institutional specificity.

The translation of *wissenschaftlich* as "scientific" illustrates this effect. The broader German notion of research-based academic work is narrowed to a disciplinary domain associated primarily with the natural sciences, with implications for how qualifications and institutional profiles are understood internationally.

LLMs offer greater flexibility, generating alternatives such as "academic work" or "evidence-based methods" when prompted. Yet this sensitivity is not automatic. Contextual differentiation only emerges when institutional knowledge is actively supplied through prompting.

Thus, where translation is treated as a technical service, AI systems reinforce dominant linguistic norms and contribute to conceptual convergence. However, with human expertise, lexical choices can be calibrated to strike a balance between accessibility and institutional distinctiveness.

4.2 Textual coherence, institutional voice, and the human-in-the-loop (RQ2)

At the textual level, differences between systems are more apparent in terms of coherence, register, and institutional voice. LLMs tend to produce more fluent and contextually coherent texts than NMT systems. However, neither technology can maintain a consistent institutional voice without explicit linguistic governance. AI systems tend to reproduce and even introduce inconsistencies, rather than resolve them.

A central contribution of this study is to show how LLM-based translation reconfigures the role of the human translator. Unlike NMT systems, which produce relatively fixed outputs, LLMs facilitate iterative, context-sensitive interaction via prompting. In this way, the human-in-the-loop model is not merely corrective but strategic. Prompting is thus a core professional competence through which translators shape institutional self-representation.

Strategic prompting involves integrating institutional context that is not made explicit in the source text, overriding statistically probable but conceptually weak equivalents, and calibrating tone and framing for different stakeholder audiences. In this way, institutional voice is co-constructed through the interaction between probabilistic systems and human expertise. When skilled translators remain actively involved in translation workflows, LLMs can enhance coherence while preserving institutional specificity.

4.3 Institutional positioning, isomorphism, European transferability (RQ3, RQ4)

At the institutional level, AI-assisted translation is part of the broader dynamics of isomorphic convergence in European higher education. The consistent rendering of *Hochschule* as “university” and the adoption of Anglophone naming conventions align institutions with globally dominant templates. While this may improve international visibility, it obscures the distinctive features of hybrid organisational forms such as the German dual higher education model.

Variation across decentralised campuses further illustrates how uncoordinated translation practices intensify these dynamics. Without shared terminology governance, AI systems favour statistically dominant equivalents and reinforce prestige bias. Translation thus becomes a mechanism through which convergence pressures are enacted.

However, convergence is not technologically predetermined. These findings challenge deterministic accounts of AI-driven isomorphism. Outcomes depend on governance structures and degrees of human mediation. When translation is embedded in a human-in-the-loop framework, AI tools can articulate hybrid identities rather than homogenise them. In this sense, skilled prompting functions as a counter-isomorphic instrument. For this to happen, translation need to be recognised and governed as a strategic institutional function.

Although these findings are based on a German case, they are transferable to other non-Anglophone universities that face similar tensions between international alignment and institutional distinctiveness.

4.4 Policy recommendations (European higher education context)

The findings confirm that AI-assisted translation should be treated as a governance issue rather than a purely technical service. Three areas require particular attention:

1. Institutionalise translation governance: AI systems should operate within structured human-in-the-loop workflows for strategically relevant texts. Post-editing should follow ISO 185.87 standards, and there should be transparent documentation of AI use and compliance with emerging EU AI regulation. Translation should be recognised as a governance function with reputational and strategic implications.
2. Develop institutional language infrastructure: Universities should establish explicit language and translation policies that define preferred English varieties and regulate identity-critical terminology. Binding terminology databases, institutional glossaries, and comprehensive style guides can help ensure consistency across decentralised campuses and departments, and can be integrated into AI-supported workflows.

CC BY NC

3. Invest in professional expertise: Technological transformation does not eliminate the need for expertise; it redistributes it. In AI-supported environments, professional competence encompasses skillful prompt design, critical evaluation of probabilistic output, and strategic awareness of institutional positioning. Therefore, it is incumbent on universities to invest in skilled translators with knowledge of higher education systems, and to support professional networks that promote shared standards and reflective practice across the European Higher Education Area.

By integrating AI within robust governance frameworks, strengthening language policies and investing in professional expertise, universities can benefit from technological innovation while safeguarding their institutional distinctiveness.

4.5 Limitations of the study and suggestions for future research

The findings are based on a qualitative case study of a single German higher education institution, and are therefore analytically rather than statistically generalisable. Focusing on selected institutional texts prioritises close textual analysis over large-scale corpus methods or empirical research on audience reception.

Future research could build on these findings by conducting comparative and longitudinal studies across different national systems, institutional types, and stages of organisational change. Reception-oriented research would be particularly valuable in examining how translated institutional identities are interpreted by international stakeholders. Further work could also explore the role of professional university translator networks and discourse communities in institutional isomorphism, investigating whether shared norms and practices primarily reinforce convergence or also enable the preservation of institutional distinctiveness.

Ethical declarations

- Conflict of interest: This author declares no conflict of interest.
- Funding: This research received no additional funding.
- Research ethics approval: This study did not involve human participants, personal data, or sensitive materials that require formal ethical approval.

References

Ammon, U. (2012). Linguistic inequality and its effects on participation in scientific discourse and exchange. *Language Problems and Language Planning,* 36(3), 187–202.

Ashford, S. (2019). *Universität or university? Organisational identity in translation, and why German universities look different in English* [Doctoral dissertation, University of Bath].

Ashford, S. (2021). Flashpoints in institutional translation. In *Vom Ohrenspiel Abdallahs und den Grenzen künstlicher Intelligenz: Interkulturelle Kommunikation für Dolmetscher und Übersetzer* [Abdallah's ear play and the limits of artificial intelligence: Intercultural communication for interpreters and translators] (Vol. 2, pp. 11–33). BDÜ Fachverlag.

Behmel, A., & Neudorfer, K. (2016). *The foreigner's guide to German universities*. Ibidem-Verlag.

Büttner, A. (2025, January 18). *Leitfaden für den Einsatz maschineller Übersetzung und KI-basierter Übersetzungstools im Hochschulkontext* [Guidelines for the use of machine translation and AI-based translation tools in higher education]. International Office Sprachenzentrum, Hochschule Bielefeld – University of Applied Sciences and Arts.

Crain, A. (2025, April 1). *Being human: Why context matters* [Conference presentation]. 11th Network Meeting of University Translators, University of Mannheim.

Cunliffe, L. (2025, April 1). *Beyond click-and-translate: Strategic responses to the AI translation shift at universities* [Conference presentation]. 11th Network Meeting of University Translators, University of Mannheim.

de Boer, H., Enders, J., & Schimank, U. (2007). On the way towards new public management? The governance of university systems in England, the Netherlands, Austria, and Germany. In D. Jansen (Ed.), *New forms of governance in research organizations* (pp. 137–152). Springer. https://doi.org/10.1007/978-1-4020-5831-8_5

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*(2), 147–160. https://doi.org/10.2307/2095101

do Carmo, D. (2025a). *Evidence review report on the use of AI for multilingual communication in public services*. University of Surrey. https://doi.org/10.15126/901629

do Carmo, D. (2025b, December 10). *An open letter to colleagues: We are not mops* [Social media post]. LinkedIn.

do Carmo, D., & Moorkens, J. (2020). Differentiating editing, post-editing, and revision. In M. Koponen et al. (Eds.), *Translation revision and post-editing*. Routledge. https://doi.org/10.4324/9781003096962

Fleisig, E., Smith, G., Bossi, M., Rustagi, I., Yin, X., & Klein, D. (2024, November). Linguistic bias in ChatGPT: Language models reinforce dialect discrimination. In *Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processing* (pp. 13541–13564). Association for Computational Linguistics. https://doi.org/10.18653/v1/2024.emnlp-main.750

Gimpel, H., Hall, K., Decker, S., Eymann, T., Lämmermann, L., Mädche, A., Röglinger, R., Ruiner, C., Schoch, M., Schoop, M., Urbach, N., & Vandirk, S. (2023, March 20). *Unlocking the power of generative AI models and systems such as GPT-4 and ChatGPT for higher education: A guide for students and lecturers.* University of Hohenheim.

Hüther, O., & Krücken, G. (2019). *Higher education in Germany: Recent developments in an international perspective*. Springer. https://doi.org/10.1007/978-3-319-61479-3

Kleimann, B. (2019). (German) universities as multiple hybrid organizations. *Higher Education, 77*(6), 1085–1102. https://doi.org/10.1007/s10734-018-0321-7

Lawrence, P. A. (2007). The mismeasurement of science. *Current Biology*, 17(15), R583–R585.

Landeskoordinationsstelle für Übersetzungsangelegenheiten (LKS). (2025). *Post-editing: Ein Muss beim Übersetzen mit maschinellen Übersetzungstools* [Post-editing: A must when translating with machine translation tools]. https://www.uni-mannheim.de/lks-uebersetzung/best-practice/trends-und-entwicklungen/post-editing-ohne-geht-nicht/

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), 340–363.

Nunes Vieira, L. (2024). *Uses of AI translation in UK public service contexts: A preliminary report*. Chartered Institute of Linguists. https://tinyurl.com/mw48hx7y

Ottmann, A., & Canfora, C. (2021). Risiken und Haftungsfragen bei neuronaler maschineller Übersetzung [Risks and liability issues in neural machine translation]. In J. Porsiel (Ed.), *Maschinelle Übersetzung für Übersetzungsprofis* [Machine translation for professional translators] (pp. 171–184). BDÜ Fachverlag.

Reager, S. (2024). ChatGPT solves some translation conundrums. *Speech Technology*. https://www.speechtechmag.com/Articles/Columns/In-Other-Words/ChatGPT-Solves-Some-Translation-Conundrums-163365.aspx

Siepmann, D. (2016). *Wörterbuch Hochschule Deutsch–English, Englisch–Deutsch: Dictionary of German higher education terminology*. Deutscher Hochschulverband.

Vera-Baceta, M.-A., Thelwall, M., & Kousha, K. (2019). Web of Science and Scopus language coverage. *Scientometrics*, 121, 1803–1813. https://doi.org/10.1007/s11192-019-03264-z

European Scientific Journal for Dual Higher Education

Vol. 2, No. 2 (2026)
ISSN (online): 3052-7015

INTERPROFESSIONAL EDUCATION IN HEALTH SCIENCES PROGRAMMES: ENABLING COMPETENCE DEVELOPMENT THROUGH CONSTRUCTIVE ALIGNMENT

Jan-Hendrik Ortloff [1*], *Manfred Fiedler* [1] and *Daniela Schmitz* [1]

[1] *Witten/Herdecke University, Germany*

Keywords:
Interprofessional education
Constructive alignment
Competence development
Professional identity formation

Article history:
Received: 13 November 2025
Revised: 26 March 2026
Accepted: 14 April 2026

To cite this article:
Ortloff, J.-H., Fiedler, M. & Schmitz, D. (2026). Interprofessional Education in Health Sciences Programmes: Enabling Competence Development Through Constructive Alignment. European Scientific Journal for Dual Higher Education (ESJ DHE), 2 (2), 83-98.
https://doi.org/10.82321/07MA-34M67

Abstract
This study examines how interprofessional education in higher education can be designed coherently to foster interprofessional action competence. Drawing on the framework of Constructive Alignment, the study investigates how learning outcomes, teaching methods, and assessment formats can be aligned to support the development of professional, methodological, social, and self-competence. Based on qualitatively analysed interviews with lecturers, the study explores how interprofessional education is implemented in practice and how students' prior experience and practical training components, including peer-to-peer learning formats, are integrated into learning processes. The study addresses the research question: How can teaching in higher education be designed in accordance with constructive alignment to promote the development of interprofessional action competence?

1 From knowledge to action competence: Didactic design of interprofessional education through constructive alignment

In higher education, a fundamental shift is taking place away from mere knowledge transmission and towards the promotion of sustainable competencies that are relevant to professional and societal life (Huber & Reinmann, 2019). The overarching learning outcome is not only the acquisition of professional, methodological, social, or personal competencies, but also, increasingly, the resulting action competence. This understanding of competence links cognitive aspects with the motivational, volitional, and social readiness to act in variable action situations (Weinert, 2001). Competencies therefore include not only theoretical knowledge, but also its application in variable action situations, referred to as *knowledge-in-action* (Hartz et al., 2022). In this context, didactic-methodological concepts associated with pedagogical constructivism represent a suitable approach, as they view learning as an active process of knowledge construction. Particular

* Corresponding author
E-mail address: Jan-Hendrik.Ortloff@uni-wh.de

emphasis is placed on problem- and case-oriented learning formats, cooperative learning arrangements, and authentic, practice-based tasks in which knowledge is constructed through application, interaction, and reflection (Dennick, 2016). Teaching and learning formats based on constructivist principles can promote collaborative, context-related learning and cooperative problem-solving among participants from different health professions (Choi et al., 2024). Learning outcomes, however, must be defined and operationalised in advance to ensure that they are effectively achieved (Huber & Reinmann, 2019). These approaches are closely linked to constructive alignment, in which learning outcomes, teaching methods, and assessment formats are coherently aligned (Biggs, 2014), thereby enabling learners to understand and actively participate in knowledge construction on the basis of transparent learning outcomes.

Such teaching and learning settings offer opportunities to apply action competencies in variable action situations, particularly in the context of interprofessional collaboration. Interprofessional teaching and learning is increasingly recognised in health professions and medical education as a prerequisite for patient-centred and future-oriented collaboration in healthcare and is implemented within the framework of interprofessional education (Reeves et al., 2017). The aim of interprofessional teaching is to develop interprofessional competence, which is manifested, for example, in joint performance when addressing complex problems as part of professional and methodological competence (Walkenhorst & Hollweg, 2023). Against this background, Oevermann (2000, as cited in Glässel, 2024, p. 4) emphasises the importance of capturing individual logics of action, whose diverse contextual factors exclude purely monoprofessional care. In interprofessional learning, a shared understanding of cases supports the coordination of treatment plans and contributes to more effective care (Langberg et al., 2019; Berchtold et al., 2020). Real case scenarios are therefore particularly suitable for interprofessional teaching and learning formats, as they support competence acquisition and allow content, teaching methods, and assessment formats to be aligned with the respective case situations (Glässel, 2024).

Three developments in didactic design are particularly relevant: the inverted classroom approach creates equal starting conditions and supports preparation for targeted competence development (van Diggele et al., 2020). Online teaching formats, as well as practice-oriented settings such as interprofessional training wards, further promote interprofessional education (Kaap-Fröhlich et al., 2022). Through the targeted alignment of learning outcomes, methods, and assessments in line with constructive alignment, learners can actively construct and apply knowledge. In this regard, the article indicates that interprofessional action competencies in higher education can be developed effectively through constructivist, practice-based, and cooperative learning formats in interprofessional education.

2 Interprofessional teaching in health sciences programmes

The increasing complexity of healthcare requires not only knowledge, but also the ability to apply this knowledge in variable action situations and, for example, to collaborate interprofessionally with other professional groups. Against this background, the *Framework for Action on Interprofessional Education and Collaborative Practice* provides a structural foundation that emphasises the practice-oriented design of teaching and learning formats and distinguishes between interprofessional teaching (interprofessional education) and interprofessional collaborative practice (World Health Organization, 2010).

The implementation of interprofessional education aims to systematically prepare learners for interprofessional collaboration (Gerber & Rüefli, 2021). Members of different health professions are expected to learn about, from, and with each other in order to improve outcomes (Walkenhorst & Hollweg, 2023), promote collaboration in complex care systems, and support the acquisition of interprofessional competencies (Ortloff et al., 2026; Kaap-Fröhlich et al., 2022) Although interprofessional education has gained importance in health sciences programmes, monoprofessional teaching and learning formats provide only limited preparation for interprofessional collaboration (Sottas, 2016). This can occur even at universities where several faculties are present on campus (Behrend, 2024). At institutions that primarily view teaching as vocational training, the increasing specialisation and differentiation of professional groups further

complicate interprofessional collaboration (Nauerth, 2024). It follows that the effectiveness of interprofessional education does not depend solely on the transmission of professional content, but also on deliberate design in line with constructive alignment, using practice-oriented teaching and learning formats that systematically promote the competencies to be acquired by participants (learning outcomes) and assess them accordingly. Defining these learning outcomes is a particular challenge, as not all participants acquire the same competencies (Thistlethwaite & Moran, 2010). Interprofessional teaching and learning formats particularly foster reflection on one's own professional role, the roles of others, and issues at professional interfaces (Dahmen et al., 2016). As part of planning and implementation, instructors have a significant responsibility for preparing learners for interprofessional collaboration (Porter & Nandan, 2017, as cited in Walkenhorst & Hollweg, 2023, p. 2). Formats such as peer teaching are particularly suitable for acquiring practical skills, preparing for exams, promoting role understanding, and supporting theory-practice transfer (Vogel et al., 2019). At the same time, they can be used to deepen case understanding through realistic practice scenarios integrated into teaching and assessment formats (Glässel, 2024). Regarding the implementation of interprofessional education, Alharbi et al. (2025) conclude in their systematic review that simulation- and practice-oriented formats offer the greatest potential to promote interprofessional competencies, but require sufficient resources for interaction among learners from different disciplines. To use this potential sustainably, Pitout et al. (2025) also recommend integrating interprofessional education formats into existing modules, thereby conserving resources and fostering interprofessional collaboration in the long term. Consequently, constructive alignment should be used as a design framework for interprofessional education to ensure that practice-oriented teaching and assessment formats make interprofessional learning outcomes transparent to both instructors and learners across different health sciences programmes and actively engage them in their joint implementation.

3 Interprofessional competence development

According to Weinert's (2001) classic pedagogical and psychological understanding of competence, competencies are defined as the cognitive abilities and skills available to, or acquired by, individuals to solve problems, as well as the necessary motivational, volitional, and social attitudes required to apply these solutions successfully and responsibly in variable situations. In the academic literature, numerous, partly discipline-specific interpretations of the concept of competence exist, and broader consideration of these areas is needed because they overlap, influence one another, and gain significance depending on environmental changes (Schöning & Mendel, 2021). At the same time, Mannonen et al. (2025) mapped the field of competence research and showed that many definitions share common core components, frequently referring to the integration of knowledge, skills, and attitudes as the basis for effective action in specific contexts. The competence areas according to Pfäffli (2005, as cited in Schöning & Mendel, 2021, p. 105), with a focus on higher education pedagogy, can be defined as:

- Professional competence: Encompasses subject-specific knowledge and the skills necessary to perform professional tasks appropriately.
- Methodological competence: Refers to cognitive abilities, such as problem-solving and decision-making that enable independent work.
- Social competence: Includes communicative and cooperative skills required for successful collaboration.
- Self- or personal competence: Relates to personal qualities, such as conscientiousness, as well as the capacity for emotional and motivational self-regulation.

Action competence arises from the interplay of these four competence areas and encompasses the ability to act appropriately, reflectively, and responsibly in different contexts (Kultusministerkonferenz, 2018). Moreover, this model is applied in higher education, particularly in connection with the implementation of the CORE principle (Competence Oriented Research and Education) and the competence-oriented reform of study programmes (Rósza et al., 2017).

CC BY NC

Walkenhorst & Hollweg (2023) emphasise, regarding interprofessional education, that interprofessional competencies manifest in joint performance. For private universities with a focus on inverted classrooms and online formats, the question arises of how competence acquisition can be deliberately structured through constructive alignment. In line with constructivist competence models, action competence is primarily attributed to learners and refers to the situation-appropriate integration of professional, methodological, social, and personal competencies. Constructive alignment aims to foster this action competence through the coherent alignment of intended learning outcomes, teaching methods, and assessment formats, thereby enabling learners to apply and reflect on their knowledge in variable interprofessional practice situations. With regard to instructors, it is assumed that they possess the necessary disciplinary and didactic competencies to translate these learning outcomes into coherent teaching-learning arrangements. This assumption simultaneously constitutes a theoretical premise and a potential limitation, as the effective implementation of Constructive Alignment presupposes appropriate professional development and collaborative capacity among the involved instructors.

4 Methodological approach

Within the German higher education landscape, this paper explores how constructive alignment, as a didactic design principle, can contribute to the development and implementation of interprofessional teaching-learning formats. In Germany, there are 423 universities, of which 110 are privately funded (Hachmeister, 2025), offering programmes with diverse and sometimes innovative teaching and learning formats. Kehm (2022) describes the private university sector as particularly heterogeneous in terms of student profiles, practical relevance, networks, seminar groups, and supervision. However, there is currently no evidence as to whether private universities are more flexible in responding to societal trends and integrating them into teaching and learning concepts. Within the framework of the collaborative project “Factors influencing innovative teaching and learning concepts at private universities [translated from German]” between the Technical University of Dortmund and the University of Witten/Herdecke, funded by the German Federal Ministry of Education and Research, a focus is placed on the implementation of interprofessional education and the research question: How can higher education teaching be designed in accordance with the principle of constructive alignment to promote the development of interprofessional action competence?

As part of the project, 16 full-time lecturers at private universities were interviewed between September 2024 and February 2025 using a semi-structured interview guide to systematically capture their experiences and expectations regarding interprofessional education. The sample of respondents was highly heterogeneous in terms of age, gender, disciplinary background, and teaching and professional experience, reflecting the real collaborations found at many universities and practice settings. The interviewees were asked about the following issues:

- Which learning outcomes do you associate with your teaching activities within interprofessional education?
- What is your perception of the significance of competency development in your teaching?
- Which competencies should be acquired through teaching and learning formats to prepare students for interprofessional collaboration after graduation?
- How is interprofessional teaching implemented within the programme, and how is competency acquisition assessed?

The interviews were conducted via Zoom, transcribed using MAXQDA 24, anonymised according to the publication-oriented strategy proposed by Reichertz (2015), and subsequently analysed using the structured content analysis method developed by Kuckartz (2016). The interviews were first read in full; relevant passages were clustered, and then coded. The qualitative data analysis was guided by the central quality criteria for qualitative research outlined by Steinke (2009).

The rule-guided analytical process was supported by a structured interview guide and a systematic coding procedure. Categories were developed iteratively and continuously checked against the empirical material. To ensure intersubjective comprehensibility, the process was transparently documented, and interpretations remained close to the data. Communicative validation was also conducted with the interviewees to assess the plausibility of the interpretations. Deductive categories were based on Pfäffli's (2005, as cited in Schöning & Mendel, 2021, p. 105) competence model, which encompasses professional, methodological, social, and personal competencies. These were complemented by inductively developed dimensions derived from the transcribed interviews and categorised according to the authors' definitions (see Results, Section 5.1 - 5.4). To analyse how lecturers prepare students for interprofessional education using inverted classroom learning formats (Table 5), implement these in interactive teaching-learning formats (Table 6), and employ assessment formats (Table 7), corresponding inductive categories were developed from the material. No quantification of text passages was performed. The coding system was iteratively refined and reviewed by two additional researchers to support consistency and transparency. This approach ensured a clear, systematic progression from raw data to results and integrated both deductive and inductive categories. Figure 1 illustrates this process using two examples: Example 1 shows a literal assignment of a text passage to a dimension, whereas Example 2 shows a paraphrased assignment of a text passage to a dimension.

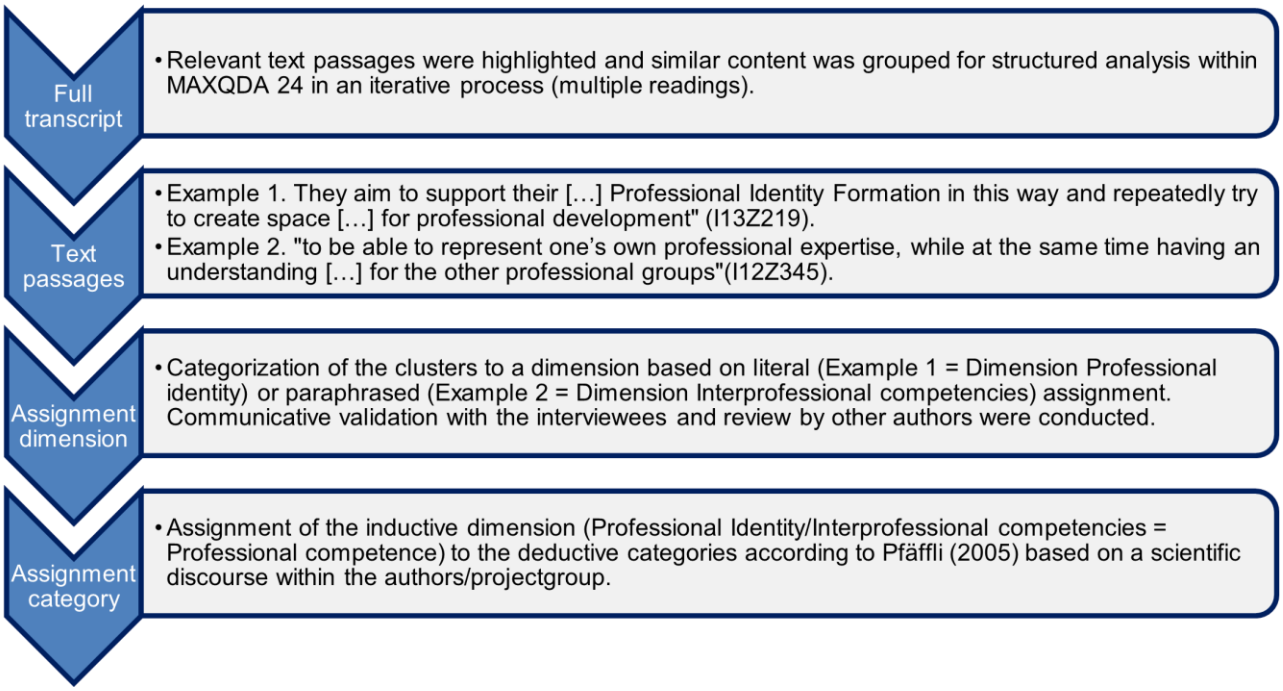

Figure 1. Example of the data analysis process

5 Results

The inductive dimensions derived from the qualitative content analysis were assigned, based on their definitions, to the competence areas described in Section 3 (professional, methodological, social, and self- or personal competence) according to Pfäffli (2005, as cited in Schöning & Mendel, 2021, p. 105) and are presented below. Additionally, it is shown how the interviewees design and implement interprofessional education in accordance with constructive alignment.

5.1 Professional competence

The analysis shows that professional competence was understood as a central qualification encompassing not only knowledge, but also its application and action competence, and that it is

closely linked to methodological skills and contextual knowledge. Table 1 summarises the key aspects of professional competence derived from the interview codes (I) and provides the line numbers (Z); the quotations were translated into English by the author.

Table 1. Dimensions of the category "professional competence"

Dimension	*Definition*	*Anchor example*	*Interview codes*
Theory-practice transfer	To apply a theory in practice and extract insights from practice	„This of course presupposes specific or module-specific professional knowledge that the students possess, but also the competencies to analyze data, theories, and models, to be able to apply them, and to draw conclusions from them" (I15Z119).	I3Z157 I4Z207 I7Z289 I12Z314 I15Z119
Contextual knowledge	To consider the conditions, contexts, and settings of future professional practice	"…that they also implement what they are supposed to learn, that is, to apply what they have learned in the contexts in which they will work in the future, meaning the different settings and various work contexts" (I14Z211).	I5Z273 I14Z211
Interprofessional competencies	To take into account one's own and other professions' role perceptions	"to be able to represent one's own professional expertise, while at the same time having an understanding […] for the other professional groups" (I12Z345).	I6Z254 I13Z219
Professional identity	Formation of professional identity and values	They aim to support their […] Professional Identity Formation in this way and repeatedly try to create space […] for professional development" (I13Z219).	I3Z241 I5Z386 I12Z345 I13Z219 I14Z341 I15Z140

The interviewees emphasised theory-practice transfer. Students should be able to reproduce content by drawing conclusions from theories and data and applying them (I3Z157, I15Z119), possess both foundational knowledge in their field (I7Z289) as well as theoretical concepts and fundamentals (I4Z207), and have practical competencies to work in their respective professions (I12Z314). Contextual knowledge also refers to a basic understanding of data literacy and the functioning of language models (I5Z285), as well as the ability to apply evidence-based knowledge in different work contexts (I14Z211). Interprofessional competencies are described in relation to Professional Identity Formation (I13Z219), differentiation from the role of reference disciplines (I14Z341), and future skills and transformative competencies (I6Z254). Statements regarding professional self-concept include, in addition to value pluralism and mental flexibility (I5Z386), the ability to develop a mindset (I3Z241), academic self-efficacy (I3Z240), and the handling of conflicting information (I15Z140).

5.2 Methodological competence

The interviewees viewed methodological competence as a central key qualification and as the foundation of professional action competence, which is conveyed in a practice-oriented, reflective, and application-related manner and is closely linked to professional competence. Table 2 presents the dimensions coded from the interviews.

Table 2. Dimension of the category "methodological competence"

Dimension	*Definition*	*Anchor example*	*Interview codes*
Scientific Work	Acquire the ability to work scientifically	"…so to speak, the ability to conduct a scientific analysis of issues" (I15Z177).	I1Z275 I2Z298 I3Z95/195 I7Z290 I8Z645 I9Z521 I15Z117
Understanding structures, designing them, and working systematically	Be able to systematically design, apply, and evaluate a theory-practice transfer or process.	"To work systematically; that is, to investigate a question - whether in the classical scientific sense or arising from professional practice - in a systematic way" (I8Z322).	I2Z529 I5Z277 I8Z322 I14Z220

According to the statements, methodological competence encompasses both formal and subject-related skills and is closely linked to an understanding of theory, enabling students to make informed decisions. The statements refer to the ability to conduct scientific analyses of issues (I15Z117), statistics (I1Z275) and computational models (I9Z521), citation methods (I2Z298) and academic writing (I3Z95), the application of models and hypotheses (I3Z195), experimental understanding (I7Z290), as well as systematically addressing a question or problem (I8Z322). Regarding the subcategory "understanding structures, designing, and acting systematically," the interviewees mentioned the development of research designs and questionnaires (I2Z529), the knowledge required to verify hypotheses and apply appropriate technologies (I5Z277), the use of artificial intelligence (I8Z645), and the transfer of knowledge from theory to mechanisms in practice (I14Z220).

5.3 Social competence

The interviewees' statement indicate that social competence is closely interrelated with other competence areas. One interviewee emphasises that it is about "not only developing professional competencies but also communication skills and organisational competencies" (I10Z241). Table 3 presents the dimensions of social competence.

Table 3. Dimension of the category "social competence"

Dimension	*Definition*	*Anchor example*	*Interview codes*
Collaboration with other professions	Apply manners, recognize the needs of other professions, evaluate contents, and make decisions	„So first you see different working cultures. You learn to communicate. You learn and see how the colleagues communicate with each other. You see good examples and bad examples" (I14Z301).	I3Z448/742 I4Z205 I5Z334 I7Z295 I9Z579 I10Z299 I14Z301
Collaboration with patients	Perception of needs, actions, and their reflection with regard to interaction with patients	"that perception changes in experts compared to non-experts, meaning that students must also be able to recognize what is happening in everyday situations, interpret it accordingly, and develop perception and action processes" (I3Z370).	I1Z70 I3Z370 I13Z281

In the interviews, social competence was primarily associated with the ability to communicate with other professional groups (I4Z205, I14Z301), teamwork (I9Z579), and conflict management (I3Z742). In addition, reflection skills (I5Z334), emotion regulation (I3Z448), critical evaluation and decision-making competence (I7Z295), and the ability to recognise the needs or requirements of

other professions (I10Z299) are considered cross-cutting competencies. Beyond perceptual and action processes (I3Z370), social competence also refers to collaboration (I1Z70) and the establishment of relationships with patients (I13Z281).

5.4 Self- or personal competence

Regarding self-competence, the interviewees emphasise the personal development of students. This requires a supportive learning environment, facilitated by reflective (I6Z259, I7Z454) and interactive (I5Z199, I7Z221, I10Z358) learning formats that promote exchange among students (I3Z672) and take place in small groups (I9Z124, I11Z439, I12Z438). Table 4 presents the statements on self-competence.

Table 4. Dimensions of the category "self- or personal competence"

Dimension	*Definition*	*Anchor example*	*Interview codes*
Personal competencies	Development of personal competencies	"This means that students should be able to form their own understanding of a phenomenon or a situation […] that is, they should be enabled to develop solutions themselves" (I9Z358).	I4Z279 I9Z358 I13Z214 I15Z125

Overall, the interviewees viewed self-competence as a fundamental element of student development, and its promotion occurs implicitly yet purposefully. Within personal competencies, the interviewees differentiated between organisational and time-management (I4Z279), the development of personal skills and attitudes (I13Z214) to independently develop solutions (I9Z358), and the preparedness to evaluate options, manage changes, and draw practice-relevant conclusions (I15Z125).

5.5 Interprofessional competence in practice

The analysis shows that the four competence areas are considered relevant for interprofessional collaboration by the interviewees, and that students can draw on their prior professional training. One interviewee described this as follows: "the strongest point of connection for interprofessional collaboration is that so many students bring their own professional training" (I13Z257). Against this background, the acquisition of interprofessional competencies can be deliberately planned by integrating students' existing professional experiences – or the absence of such training – into the structuring of learning outcomes, teaching, and assessment formats in accordance with constructive alignment (Biggs, 2014).

Learning outcome: From the interviews, interprofessional action competence can be derived as an overarching learning outcome from the four competence areas described by Pfäffli (2005, as cited in Schöning & Mendel, 2021, p. 105). For the interviewees, this included both confidently representing one's own professional expertise and understanding other professional groups. Central to this is the theory-practice transfer to real care situations, which students should adapt depending on contextual knowledge and apply using interprofessional competencies (Table 1). Through the acquisition of methodological competence and structured approaches, interprofessional work processes can be reflected on, optimised, and transferred to different settings. Scientific work also enables students to critically analyse interprofessional processes and design them based on evidence (Table 2). Social competence encompasses the ability to communicate with other professional groups or patients, recognise the needs of other professions, and make joint decisions (Table 3). Furthermore, organisational and time management skills promote the development of personal skills and attitudes, as well as constructive, context-appropriate handling of change. In this way, self-competence enables students to make decisions and assume responsibility in interprofessional contexts (Table 4).

Teaching and learning formats: The results show that interprofessional teaching is delivered, among other methods, through asynchronous self-learning formats in line with an inverted classroom

approach. The interviewees frequently referred to study guides and scripts, as well as teaching videos and audio formats (Table 5). These are complemented by interactive teaching and learning formats (Table 6). According to the interviewees, the proportion of digital learning units is increasing, as they can be pragmatically adapted through integrated tools and short update cycles (I7Z218). In this approach, the initial input is delivered asynchronously, whereas practice, transfer, and reflection primarily take place in person (I13Z608). Another example is lecture recordings, which provide students with the added value of being able to review and refresh content flexibly (I6Z548).

Table 5. Inverted classroom learning formats in interprofessional education

Category	*Teaching and learning formats*	*Anchor example*	*Interview codes*
Inverted Classroom	Study materials & lecture notes	"In study booklets this is handled in various ways […] - we show examples of how it works in practice, or we start with a practical problem and explore what theory can reveal about it"(I3Z864).	I1Z335 I2Z132 I3Z905 I7Z222 I9Z302 I10Z169
	Recordings, instructional videos & audio formats	"Short videos that we produce ourselves. They are used to deliver tiny pieces of information in a concise manner(I2Z135).	I1Z335 I2Z123 I3Z192 I5Z194 I6Z583 I7222 I9320 I10Z346 I11Z301 I12Z738 I14Z476 I15Z355
	Additional offerings via an online campus	"there are many variants. To summarize again: asynchronous digital learning units"(I7Z238).	I2Z214 I3Z635 I5Z499 I7Z464 I10Z442 I12Z471 I16Z421

As further offerings provided through an online campus, the interviewees mentioned personal accounts with chat functions (I7Z464), forums (I3Z635), group sessions via Teams (I2Z214), test questions and quizzes (I5Z499), and discipline-specific learning platforms such as Amboss, Moodle, and Articulate (I7Z220, I16Z421). With regard to interactive teaching and learning formats, both internal and external formats were mentioned (Table 6).

Table 6. Interactive learning formats in interprofessional education

Category	*Teaching and learning formats*	*Anchor example*	*Interview codes*
Interactive teaching and learning formats	Research-based learning (parallel to the in-person sessions)	"This means that students first engage in the project and need to plan, carry out, and analyze their experiment" (I3Z672).	I1Z478 I3Z672 I6Z334 I15Z378
	In-person sessions	"I would say that we try to align the tasks in other modules as closely as possible to practice […] for example, in the case of interprofessional care and collaboration" (I8Z354).	I1Z540 I2Z167 I3Z556/874 I5Z457 I6Z432/542 I7Z221 I10Z174 I12Z349/371 I14Z510 I15Z231/235
	External university formats	"We have an internship where students are allowed to visit a variety of learning sites" (I16Z665).	I3Z467 I4Z348 I8Z626 I10Z273/530 I14Z236 I16Z665

The interviewees differentiated research-based learning into empirical research seminars (I1Z482), psychological experiments (I3Z210), and research (I6Z334) or research-intensive projects (I15Z378). Collaboration and exchange in face-to-face sessions were facilitated through mixed learning groups (I3Z874), joint case studies (I5Z457, I6Z432, I12Z349), simulated case conferences (I12Z371), role-playing with simulated patients (I14Z510, I15Z231), podcasts (I7Z221), virtual laboratories (I10Z174), and simulation-based settings using conversational bots (I2Z167). The interviewees emphasised the potential of group work (I3Z615, I5Z342, I7Z236, I11Z512, I15Z263). These are complemented by sprint events (I1Z540), informal discussion rounds (I3Z556), marketplaces for projects and research initiatives (I6Z542), and open science practices (I15Z235). In addition to internships (I8Z626, I13Z530, I14Z236, I16Z665), the external formats mentioned included research projects (I3Z467), project work (I4Z348), and project-based collaborations with external partners (I10Z273).

Assessment formats: A similarly broad spectrum is observed in assessment formats for interprofessional education, which are conducted in both written and oral forms (Table 7).

Table 7. Assessment formats in interprofessional education

Category	*Teaching and learning formats*	*Anchor example*	*Interview codes*
Written test	Project assignments	"When they have to write project reports, they are already very close to practice (…) for example, in the case of interprofessional care and collaboration. Yes, and they should include practical examples. So at least some transfer of knowledge is happening" (I8Z491).	I3Z181 I4Z343 I5Z416 I6Z542 I7Z592 I8Z491 I9Z578 I10Z277 I15Z162

Table 7. Assessment formats in interprofessional education (continued)

Category	*Teaching and learning formats*	*Anchor example*	*Interview codes*
Oral test	Presentations including peer feedback	"In the interprofessional collaboration module, I try to promote this (…) by including assessments (…) and having them present something, introduce themselves, and present it to their colleagues" (I8Z483).	I3Z210 I4Z348 I6Z348 I7Z234 I8Z483 I13Z626

According to the interviewees, assessment tasks related to the written documentation of project work (I5Z416, I7Z592, I8Z491, I9Z578, I10Z277), joint research in clinical practice (I15Z162), scientific surveys (I6Z542), the development of business models (I4Z343), and case assignments in practice projects (I3Z181). One interviewee stated: “when they have to write the project reports […] we of course try to orient them very closely to practice, so that in the case of interprofessional collaboration […] they also bring in examples from practice” (I8Z491). Oral examinations are conducted through planning, performing, and presenting psychological experiments (I3Z210), business models and their progress (I4Z348), presentations of case assignments from internships (I8Z483), the students’ existing work context (I6Z348), as well as group work (I7Z234) and practical assessments of conversations with simulated patients (I13Z626). This was expressed as follows: “in the module on interprofessional collaboration, I naturally try to promote this theoretically […] a subject presentation in this case […] where they also introduce themselves and present it to their colleagues” (I8Z383). The interviewees emphasised the relevance of peer feedback (I4Z592, I5Z421, I7Z339, I13Z639, I14Z450). One interviewee succinctly described this as follows: “So the assessment in a course where […] the competence to work interprofessionally is in the foreground […] is designed so that the students are in communication” (I12Z402). The results illustrate how learning outcomes for interprofessional education (e.g., competence acquisition, Tables 1-4) are implemented through corresponding teaching and learning formats (Tables 5 and 6) using selected assessment formats (Table 7) in accordance with constructive alignment, as described by the interviewees (Figure 2).

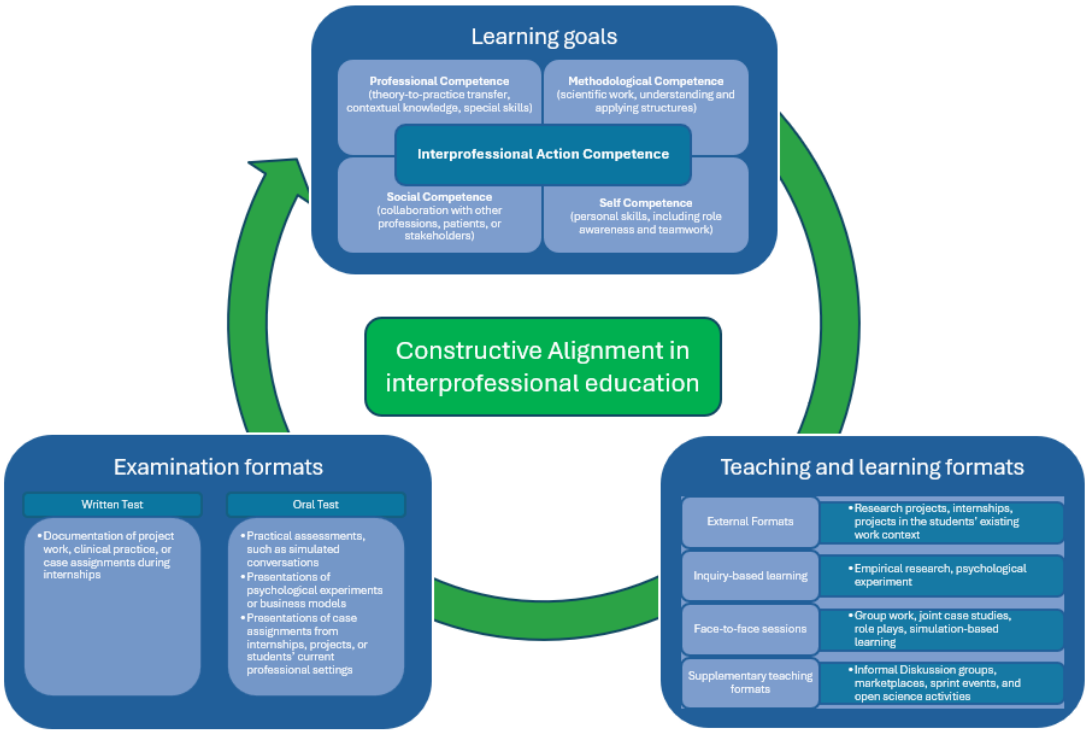

Figure 2. Constructive Alignment in interprofessional education: Own illustration, based on a previous publication

6 Discussion

The results show that interprofessional education was considered relevant by the interviewees for the development of interprofessional action competence. Instructors can define individual competence development as a goal (Kaap-Fröhlich et al., 2022) and, as Porter & Nandan (2017, as cited in Walkenhorst & Hollweg, 2023, p. 2) state, assume responsibility for planning and implementation so that students are prepared for interprofessional collaboration (Gerber & Rüefli, 2021). The interviewees reported that the teaching and learning formats enable students, among other things, to communicate with each other (I14Z301), recognise the needs of other professions (I10Z299), and promote exchange among themselves (I3Z672). This aligns with criteria identified in the literature (Walkenhorst & Hollweg, 2023; Reeves, 2017; World Health Organization, 2010), according to which interprofessional education occurs when learners from different professions learn about, from, and with each other to improve collaboration and outcomes. For the didactic implementation of interprofessional education, the theoretical framework of constructive alignment (Biggs, 2014) provides a systematic basis: learning outcomes, teaching methods, and assessment formats are coherently aligned so that competence acquisition occurs intentionally rather than incidentally.

6.1 Developing competence as a teaching goal

The 16 interviewees emphasised the importance of professional, methodological, social, and self-competence in deliberately preparing students for professional practice. For the development of interprofessional action competence, theory-practice transfer, professional role understanding, contextual knowledge, and cross-disciplinary skills (Table 1) were particularly targeted and complemented by scientific work and a systematic approach (Table 2). Furthermore, the focus was on fostering students' ability to collaborate with other professions and patients (Table 3) and on developing personal competencies (Table 4) are focuses. Accordingly, all competence areas according to Pfäffli (2005, as cited in Schöning & Mendel, 2021, p. 105) are addressed so that students can develop interprofessional action competence as an overarching competence (Kultusministerkonferenz, 2018). This multidimensional approach reflects broader competence research, which conceptualises competence as an integrative construct combining knowledge, skills, and attitudes that enable effective action in complex professional contexts (Mannonen et al., 2025). The present results support Hartz et al.'s (2022) assertion that knowledge in action and its application in variable action situations can already be acquired during studies through interprofessional education. Theoretically, this aligns with Weinert's (2001) understanding of competence as an interplay of cognitive, motivational, and social components. With a focus on individual competence acquisition, where not all students learn the same (Thistlethwaite & Moran, 2010), the interviewees highlighted learning outcomes in line with transformation in higher education (Huber & Reinmann, 2019), which go beyond mere knowledge transmission to foster professionally and socially relevant competencies. The reflection on one's own and cross-professional roles, as described by Dahmen et al. (2016), is specifically promoted according to the interviewees (Table 1). Contrary to the assumption that the specialisation and differentiation of professional groups hinder interprofessional collaboration (Nauerth, 2024), the interviews indicate that students' professional backgrounds provide a central access point to interprofessional learning (I13Z257). In this context, it remains to be discussed what advantages and disadvantages heterogeneous student groups with varying professional experience bring, as well as the role of available resources and teacher competencies.

The need for a broader consideration of competence areas (Schöning & Mendel, 2021) is also evident by the interviewees' statements. For example, regarding contextual knowledge, the interviewees emphasised that professional and methodological competences should not be considered in isolation (I14Z211), as these competence areas are closely interlinked (Tables 1 and 2). Social competencies such as communication skills (I4Z205, I14Z301), teamwork (I9Z579), and conflict management (I3Z742) were rated as central by the interviewees and are also reflected in international frameworks for interprofessional education (Ortloff et al., 2026; Kaap-Fröhlich et al., 2022). Overall, the results demonstrate that the deliberate promotion of professional,

methodological, social, and personal competencies through integrated teaching and learning formats effectively supports the development of interprofessional action competence.

6.2 Instructional formats in interprofessional education

Joint performance in collaboratively solving complex problems (Walkenhorst & Hollweg, 2023) is addressed in various internal and external teaching and learning formats at universities. The interviewees' statements (e.g., I6Z254, I7Z289, I13Z219) support Vogel et al.'s (2019) assertion that peer-teaching formats promote role understanding and theory-practice transfer. Preparatory measures include inverted classroom formats (van Diggele et al., 2020), in which study guides, scripts, instructional videos, audio formats, and online campus offerings are used to support competence acquisition before in-person sessions (Table 5). In parallel, teaching activities from research-based learning or internships are employed so that students acquire interprofessional action competence (Table 6). The interviewees focused on capturing individual action logics within case understanding (Oevermann, 2000, as cited in Glässel, 2024, p. 4) in variable action situations (Hartz et al., 2022), thereby deliberately integrating contextual factors into the teaching and learning formats (I5Z273, I14Z211). Case studies or practice-oriented problems are worked on in advance, allowing in-person time to be used primarily for discussion, application, and reflection (I13Z608). The question remains how instructors assess students' preparation levels and to what extent students actually use the provided inverted classroom materials.

Interprofessional teaching and learning formats are oriented towards case understanding, which, owing to multiple contextual factors, excludes purely monoprofessional care (Sottas, 2016). In interprofessional learning, collaborative case understanding supports the coordination of treatment plans and contributes to more effective care (Langberg et al., 2019; Berchtold et al., 2020). Real case situations provide a suitable setting for this, as the competencies to be developed serve as central reference points for content, teaching and learning formats, and assessments (Glässel, 2024). To promote collaboration, instructors use peer-teaching formats (Vogel et al., 2019) and, following Alharbi et al. (2025), employ various methods, such as joint case work (I5Z457, I6Z432, I12Z349), simulated case conferences (I12Z371), and role-playing with simulated patients (I14Z510, I15Z231). In addition, digital formats such as podcasts (I7Z221), virtual labs (I10Z174), or simulation-based conversation bots (I2Z167) are applied and complemented by informal meetings (I3Z556), project marketplaces (I6Z542), open science practices (I15Z235), and external university projects and internships (I10Z273).

6.3 Examination formats in interprofessional education

The assessment of competence acquisition, which is relevant for professional and societal practice (Huber & Reinmann, 2019), can be carried out within the framework of interprofessional education through peer-teaching formats (Vogel et al., 2019) and tasks involving collaborative case understanding (Glässel, 2024). The interviewees implemented assessments for interprofessional education in both written and oral formats (Table 6). Regarding written assessments, the interviewees increasingly relied on external teaching and learning formats, including the documentation of joint research in clinical practice (I15Z162) or research-based learning (I3Z672), scientific surveys (I6Z542), the development of business models (I4Z343), as well as practice- or project-based assignments (Table 7). A point for discussion is the extent to which voluntary participation in interprofessional education formats (e.g., without module credit points) motivates students to complete assessments and thereby complete the constructive alignment process. According to the interviewees, teaching and learning formats for interprofessional education are integrated both resource-efficiently into existing modules (Pitout et al., 2025) and as standalone courses. Overall, the results regarding learning outcomes, teaching methods, and assessment formats support Alharbi et al.'s (2025) conclusion that simulation- and practice-oriented formats, as well as peer-teaching formats (Glässel, 2024; Vogel et al., 2019), offer substantial potential for promoting interprofessional competences.

CC BY NC

In the context of interprofessional education, the findings indicate that constructivist teaching and learning formats can be closely aligned with the principle of constructive alignment. The principles of constructivist teaching (Dennick, 2016) are reflected in the teaching and learning formats identified in the results section, such as case-based and simulation-oriented approaches as well as peer-teaching formats (Tables 5 and 6), demonstrating that cooperative learning arrangements and authentic, practice-based tasks can support the process of knowledge construction. Through the deliberate alignment of learning outcomes, teaching methods, and assessment formats in line with Constructive Alignment, students are enabled to apply, reflect on, and further develop this knowledge within interprofessional education, as illustrated by the competence-oriented assessment formats employed (Table 7). Constructivist-informed teaching and learning formats thus promote collaborative, context-related learning and cooperative problem-solving among students from different health professions (Choi et al., 2024) and support the development of interprofessional action competence, as indicated by the findings of this study.

7 Methodological strengths and limitations

Semi-structured interviews provided in-depth insights but are methodologically limited. A total of 16 interviews with faculty members from private universities were conducted, and data saturation was achieved during the data collection process, offering valid insights but not generalisable results. Data collection was conducted digitally via Zoom and covered only a short period, which may have influenced the context. The interview guide may have constrained the openness of responses, while personal affinities, follow-up questions, and nonverbal cues may have affected the course of the conversation and the interpretation of the statements. The reliability and trustworthiness of the qualitative results are described below using the criteria proposed by Lincoln and Guba (1985).

- Credibility was supported through the systematic use of semi-structured interviews, full transcription, and qualitative content analysis following Kuckartz (2016). The combination of deductive categories based on the competence model by Pfäffli (2005) and inductively developed dimensions enabled a theory-driven and data-grounded interpretation. The category system was iteratively reviewed and reflected upon by two additional researchers, thereby enhancing interpretive plausibility.
- Dependability was supported through transparent documentation of all methodological steps – from data collection and transcription to category development – and the consistent application of a rule-based analytical procedure (Kuckartz, 2016). Anonymisation followed a publication-oriented strategy (Reichertz, 2015), ensuring traceability of the analytical process while adhering to ethical standards.
- To strengthen confirmability, codes and categories were discussed and reflected upon within the research team. The findings are closely linked to the empirical material and are transparently supported by interview quotations.
- The transferability of the findings is limited because of the qualitative sample of 16 lecturers from private higher education institutions. However, the detailed description of the sample, institutional context, and didactic framework allows for context-sensitive transferability to comparable higher education settings.
- Regarding researcher reflexivity, disciplinary backgrounds, experience in higher education didactics, and preconceptions concerning interprofessional education were continuously reflected upon and discussed within the research team to make their potential influence on data collection and interpretation explicit.

8 Conclusion

The study results demonstrate that interprofessional education is far more than an adjunct to existing teaching and learning formats. It represents a fundamental paradigm shift in higher education, moving away from mere knowledge transmission towards knowledge-in-action, which

deliberately prepares students for complex interprofessional professional fields. Based on the framework of constructive alignment, interprofessional education can effectively contribute to the development of interprofessional action competencies when learning outcomes, teaching formats, and assessments are coherently linked, as outlined. Instructors employ mixed learning groups, case- and project-based approaches, simulations, and inverted classroom models, while external learning sites such as internships additionally promote theory-practice transfer but require substantial resources. Overall, the analysis suggests that the promotion of interprofessional action competencies targets not only subject-specific and methodological dimensions, but also students' personal development and professional identity formation. Consequently, interprofessional education becomes an integral part of higher education that holds societal relevance beyond labour market preparation. Three key implications for higher education didactics emerge, irrespective of institutional type: First, the implementation and curricular integration of interprofessional education should be systematic to ensure consistent competency development. Second, a selection of teaching and learning formats is required that integrates both internal and external offerings while ensuring both controllability and real-world relevance. Third, assessment formats and evaluation methods need to be developed that adequately reflect personal and social dimensions and extend beyond purely cognitive evaluation.

Ethical Considerations

The study was conducted in accordance with established ethical standards for research involving human participants. Within the framework of the project "Factors influencing innovative teaching and learning concepts at private universities [translated from German]", ethical clearance was obtained from the Ethics Committee at the Technical University of Dortmund. Participation in the interviews was entirely voluntary, and all participants received detailed information about the purpose of the study, the methods, and the intended use of the data. Informed consent was obtained from all interviewees prior to data collection. To ensure confidentiality and protect personal data, the interviews were anonymised, and all identifying information was removed from the transcripts. The handling of data complied with relevant data protection regulations, and access to the raw data was limited to the research team. Ethical considerations were continuously monitored throughout the study to ensure the respectful and responsible treatment of participants.

Conflict of Interest

The author declares no conflict of interest.

References

Alharbi, N. S., Albilehi, R., Bukhari, L., Albaz, N. K., Alkahtani, R., Nasser, S., & Aldriwesh, M. G. (2025). Interprofessional education: A systematic review of educational methods in postgraduate health professions programs. *The Clinical Teacher.*, 22(1), 1–11.

Behrend, R. (2024). Interprofessionalität in der beruflichen Bildung, Hochschulbildung und Fort- und Weiterbildung: Bedeutung und Stand der Umsetzung [Interprofessionality in vocational, higher and continuing education: Importance and implementation status]. In U. Walkenhorst & W. Hollweg (Eds.), Interprofessionelle Bildung für die Gesundheitsversorgung (pp. 1–11). Springer.

Berchtold, P., Gedamke, S., & Schmitz, C. (2020). Quality through patients' eyes. Schweizerische Patientenorganisation (pp. 2–17). https://www.bag.admin.ch/dam/de/sd-web/nw8PmkENA38Q/quality-through-patients-eyes.pdf

Biggs, J. B. (2014). Constructive alignment in university teaching. *HERDSA Review of Higher Education*, 1, 5–22.

Choi, Y.-R., Lee, Y.-N., Kwon, D. Y., Kim, D., Park, W. H., & Chang, S. O. (2024). The development and effects of a social constructivist approach in an interprofessional discomfort care online education program. BMC Medical Education, 24, 1363.

Dahmen, U., Schulze, C., Schindler, C., Wick, K., Schwartze, D., Veit, A., & Smolenski, U. (2016). Empfehlungen zur Verbesserung des konstruktivistischen Lernens in der interprofessionellen Ausbildung durch videobasierte Selbsteinschätzung [Recommendations for improving constructivist learning in interprofessional education through video-based self-assessment]. GMS Journal for Medical Education, 33(2), Doc33.

Dennick, R. (2016). Constructivism: Reflections on twenty-five years teaching the constructivist approach in medical education. International Journal of Medical Education, 7, 200–205.

Gerber, M., & Rüefli, C. (2021). Definition des Begriffs Interprofessionalität im Gesundheitswesen im Schweizer Kontext [Definition of interprofessionality in the Swiss healthcare context]. In U. Walkenhorst & W. Hollweg (Eds.), *Interprofessionelle Bildung für die Gesundheitsversorgung*, (pp. 17). Springer.

Glässel, A. (2024). Fallbasiertes Lernen zur Förderung narrativer Kompetenz in der interprofessionellen Ausbildung von Gesundheitsberufen [Case-based learning to foster narrative competence in interprofessional health professions education]. In U. Walkenhorst & W. Hollweg (Eds.), *Interprofessionelle Bildung für die Gesundheitsversorgung* (pp. 4–7),Springer.

Hachmeister, C. D. (2025). DatenCHECK 1/2025: *Private und kirchliche Hochschulen* [Data check 1/2025: Private and church-affiliated universities]. https://www.che.de/download/datencheck-1-2025-private-und-kirchliche-hochschulen/

Hartz, S., Aust, K., Gottfried, L. M., & Kurtz, C. (2022). *Kompetenzentwicklung und Lerntransfer in der Hochschullehre: Eine empirische Studie mit Erhebungs- und Auswertungsinstrumenten* [Competence development and learning transfer in higher education teaching: An empirical study with assessment instruments]. Springer VS.

Huber, L., & Reinmann, G. (2019). *Vom forschungsnahen zum forschenden Lernen an Hochschulen: Wege der Bildung durch Wissenschaft* [From research-oriented to research-based learning in higher education]. Springer VS.

Kaap-Fröhlich, S., Ulrich, G., Wershofen, B., Ahles, J., Behrend, R., Handgraaf, M., Herinek, D., Mitzkat, A., Oberhauser, H., Scherer, T., Schlicker, A., Straub, C., Waury Eichler, R., Wesselborg, B., Witti, M., Huber, M., & Bode, S. F. (2022). Position paper of the GMA Committee Interprofessional Education in *the Health Professions—Current status and outlook*. GMS Journal for Medical Education, 39(2), Doc17.

Kehm, B. (2022). Private higher education in a dominantly public sector. *International Higher Education*, (109), 32–33.

Kuckartz, U. (2016). *Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung* [Qualitative content analysis: Methods, practice, and computer support]. Beltz Juventa.

Kultusministerkonferenz. (2018). Handreichung für die Erarbeitung von Rahmenlehrplänen der Kultusministerkonferenz [Guidelines for the development of framework curricula of the Standing Conference of the Ministers of Education]. https://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2021/2021_06_17-GEP-Handreichung.pdf

Langberg, E. M., Dyhr, L., & Davidsen, A. S. (2019). Development of the concept of patient-centredness: A systematic review. *Patient Education and Counseling*, 102(7), 1228–1236.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE.

Mannonen, J., Hooshyar, D., Urrutia, F., Hämäläinen, R., Araya, R., & Lehesvuori, S. (2025). The concept of competence in educational research: A knowledge map of main research traditions and topics. *Education + Training*, 67(10), 132–149. https://doi.org/10.1108/ET-02-2024-0070

Nauerth, A. (2024). Interprofessionelle Gestaltung von Hochschullehre [Interprofessional design of higher education teaching]. In U. Walkenhorst & W. Hollweg (Eds.), *Interprofessionelle Bildung für die Gesundheitsversorgung* (pp. 3) Springer.

Ortloff, J.-H., Stratmann, M., Schlicker, A., & Schmitz, D. (2026). Implementierungsstrategien von interprofessionellen Lehr-/Lernarrangements an Hochschulen [Implementation strategies for interprofessional teaching and learning arrangements]. In T. Lehnen, J. Busch, & W. von Gahlen-Hoops (Eds.), *Interprofessionelle Bildung in Pflege und Gesundheitsberufen: Curriculare Gestaltung und Strategien für die Anwendung* (in press).

Pitout, H., Barnard-Ashton, P., Adams, F., & du Toit, S. H. J. (2025). Work smarter not harder: Mapping interprofessional education collaboration core competencies across curricula. *Medical Science Educator*, 35, 1489–1502.

Reeves, S., Pelone, F., Harrison, R., Goldman, J., & Zwarenstein, M. (2017). Interprofessional collaboration to improve professional practice and healthcare outcomes. *Cochrane Database of Systematic Reviews*, 2017(6), CD000072.

Reichertz, J. (2015). Wie mit den Daten umgehen? Persönlichkeitsrechte und Datenschutz in der qualitativen Sozialforschung [Handling data in qualitative research: Privacy rights and data protection]. *Soziologie*, 44(2), 186–202.

Schöning, S. & Mendel, V. (2021). *Kompetenzentwicklung im Controlling: Mit systematischer Personalentwicklung in der Digitalisierung und Globalisierung zum Erfolg* [Competence development in controlling: Achieving success through systematic human resource development in digitalisation and globalisation]. Springer Gabler.

Sottas, B. (2016). Interprofessionelle Teams sind effizienter und senken die Kosten: Zur Evidenzlage bei einem kontroversen Innovationsthema [Interprofessional teams are more efficient and reduce costs]. In S. Müller-Mielitz, B. Sottas, & A. Schachtrupp (Eds.), *Innovationen in der Gesundheitswirtschaft* (pp. 44–56). Bibliomed.

Steinke, I. (2009). Die Güte qualitativer Marktforschung [Quality criteria of qualitative market research]. In R. Buber & H. Holzmüller (Eds.), *Qualitative Marktforschung: Konzepte – Methoden – Analysen* (2nd ed., pp. 261–289). Gabler.

Thistlethwaite, J. E., & Moran, J. M. (2010). Learning outcomes for interprofessional education. *Journal of Interprofessional Care*, 24(5), 503–513.

Van Diggele, C., Roberts, C., Burgess, A., & Mellis, C. (2020). Interprofessional education: Tips for design and implementation. *BMC Medical Education*, 20(Suppl. 2), 455.

Vogel, B., McMillan, A., & Dethleffsen, K. (2019). Peer-assisted learning—Mehr als eine Methode [Peer-assisted learning—More than a method]. In J. Noller, C. Beitz-Radzio, D. Kugelmann, S. Sontheimer, & S. Westerholz (Eds.), *Methoden in der Hochschullehre: Interdisziplinäre Perspektiven aus der Praxis* (pp. 47–48). Springer.

Weinert, F. E. (Ed.). (2001). *Leistungsmessungen in Schulen* [Performance measurement in schools]. Beltz.

Walkenhorst, U., & Hollweg, W. (2023). Interprofessionelles Lehren und Lernen in den Gesundheitsberufen [Interprofessional teaching and learning in health professions]. In I. Darmann-Finck & K.-H. Sahmel (Eds.), *Pädagogik im Gesundheitswesen* (pp. 303-318), Springer.

World Health Organization. (2010). *Framework for action on interprofessional education and collaborative practice.* https://www.who.int/publications/i/item/framework-for-action-on-interprofessional-education-collaborative-practice

EU4Dual

ISSN: 3052-7015

This journal is part of
EU4DUAL