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RESEARCH ARTICLE

Operational Readiness for AI Driven Learning: Examining the Interplay of Self-Assessed Competence, Usage Patterns and Trust

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ABSTRACT

Since the release of generative AI systems in autumn 2022, AI use in academic contexts has gained relevance worldwide. Developing AI-related competencies has emerged as an educational task within the field of learning technologies aimed at enhancing learning outcomes. Against this background, the DigiTaKS*-project investigates how usage patterns, trust in AI, and self-assessed AI compe-tencies are interrelated and how these factors influence students' operational readiness to integrate AI-driven applications into their learning processes. We frame this presented approach as an idea that can be adapted to different regions and educational systems. This contribution presents findings from a questionnaire study conducted among bachelor's students in Humanities and Social Sciences at a German university (N = 70). Results indicate that usage, trust, and self-assessed AI competence are closely intertwined and significantly predict opera-tional readiness to integrate AI into academic learning processes. These findings highlight the need for structured educational approaches that systematically foster these interrelated dimensions. In response, the Open Educational Resource (OER) "ComDigiS*" was developed within the project DigiTaKS* to systematically promote reflective, competence-oriented, and equitable AI integration in academic contexts. It conceptualizes AI as a form of machine intelligence and supports in-teracting with AI across different cognitive levels from understanding and apply-ing to critically reflecting thereby fostering a holistic set of AI-use competencies for students. However, the paper presents student AI practices based on ques-tionnaire results and the Open Educational Resource ComDigiS* for promoting (AI) competence development. Grounded in a European setting, the study pro-poses an approach intended for context-sensitive adaptation across diverse edu-cational systems. While the study is grounded in a European higher-education context, it explicitly acknowledges the situatedness of its concepts. This opens a perspective on how the proposed heuristic can be adapted to diverse educational settings across regions, such as educational contexts across the African conti-nent.

Keywords: Operational readiness, generative AI in education, trust in AI, self-assessed AI competence, Open Educational Resources (OER)

INTRODUCTION

The broad availability of generative Artificial Intelligence (AI) as a form of open access since late 2022 has substantially lowered the technical barriers to AI use. Unlike earlier digital technologies, many people with an internet connection and a digital device now have

access to a wide range of AI applications. However, this does not automatically reduce educational inequality. Rather, the locus of inequality shifts: while access remains relevant, it becomes increasingly important who has the competences to use AI reflectively, critically, and in a learning-oriented way for academic work. In higher education, this shift is particularly visible: Students increasingly use generative AI for example for information search, knowledge acquisition, and the production of academic texts (An et al., 2026). The development of students' learning opportunities depends not only on whether AI is used, but primarily on how it is used. The ability to integrate AI into learning processes in higher education can therefore be understood as a form of "operational AI readiness". The term builds on the concept of "operational readiness", which describes a subject-related readiness to use digital and intelligent technologies and includes dimensions such as acceptance, trust, usage, competences and skills (Stützer et al., 2023). In this paper, operational AI readiness refers to students' ability and willingness to integrate AI applications into academic learning practices in a purposeful, critical and reflective way.

In this paper, the concept of "operational AI readiness" is not treated as a fixed scale, but as a heuristic construct that becomes empirically visible through the interplay of trust in AI, self-assessed AI competencies, and AI usage patterns. Higher education institutions are central sites for fostering this readiness because they can promote AI-related competencies through structured didactic settings. By supporting students in developing AI competencies, universities can contribute to mitigating the AI divide and strengthening students' operational AI readiness (Digel & Biel, 2025; Weitzel & Wilhelm, 2025).

This paper asks how trust in AI, self-assessed AI competencies and AI usage patterns can serve as heuristic dimensions for assessing operational AI readiness in higher education, and how the resulting diagnostic insights can be translated into competence-oriented learning opportunities through an OER-based learning platform such as ComDigiS*.In the following sections, we first develop the theoretical framework connecting the AI divide and operational AI readiness (Chapter 2). We then illustrate, using an empirical example from the project DigiTaKS*[1] (*Digital Key Competences for Studies and Work*; Schmidt-Lauff, 2025), how trust in AI, self-assessed AI competencies, and AI usage can be operationalised as a heuristic for exploring operational AI readiness (Chapter 3). Finally, we show how these diagnostic insights can inform competence development through ComDigiS* and how this approach can be adapted to different educational contexts (Chapter 4 and 5).

AI Divide in the Context of Operational AI Readiness: An Educational Challenge

The concept of the digital divide describes unequal opportunities for access to digital information and communication technologies as well as unequal capabilities to benefit from them (Kersting, 2020; van Dijk, 2020). Van Dijk (2020) distinguishes three interrelated levels of inequality: first, a motivational and access divide; second, a competence divide; and third, a usage and outcome divide. These levels are cumulative: without access, competences cannot be developed; without competences, usage remains superficial; without meaningful usage, potential benefits are not realised. The digital divide is therefore not merely a technical problem but a structural inequality that reproduces and amplifies existing social disadvantages. Although access to digital technologies has improved in many regions, significant inequalities remain at the level of infrastructure, connectivity and digital competencies. International Telecommunication Union (2025a; b) regional reports show that these inequalities differ considerably across contexts. However, neither the African, Asian, nor the European region should be understood as homogeneous. Both comprise highly diverse countries, institutional conditions, infrastructural realities, urban and rural settings, language contexts and educational systems. Regional comparisons can therefore only indicate broader patterns, while any concrete interpretation must remain sensitive to national, local and institutional differences.

In the Africa region, Internet use remains comparatively low and strongly shaped by location, with a pronounced urban-rural divide (ITU, 2025a, 2025b). In the Europe region, overall connectivity is much higher, yet urban-rural disparities also persist, particularly in access to high-speed networks such as 5G (Eurostat, 2024; 2026). These examples illustrate the cumulative structure of the digital divide: infrastructure and access remain fundamental preconditions for digital participation, but they do not by themselves guarantee meaningful use (van Dijk, 2020; Wang et al., 2024).

This distinction is important for the argument of this paper. The concept of the AI divide is already relevant at the level of access, since unequal connectivity also shapes unequal opportunities to engage with AI applications in the first place. However, access to digital technologies does not automatically imply access to, or use of, AI applications. A further level of inequality emerges when learners have basic digital access but

[1] This chapter was developed as part of the project "Digital Key Competencies for Studies and Careers – Model for the Transformative Digital Competence Development of Students (DigiTaKS*)" (2021–2024). The project is funded by the Center for Digitalization and Technology Research of the Bundeswehr (dtec.bw) and supported by the European Union under the "NextGenerationEU" initiative.

do not use AI, whether due to lack of awareness, motivation, trust, institutional guidance or perceived relevance (Carter et al., 2020; Digel & Biel, 2025). The heuristic developed in this paper focuses on a subsequent level of this cumulative divide: contexts in which a basic level of access to digital technologies and AI applications can be assumed, as is often the case in higher education institutions (in Europe). At this level, inequalities become visible through differences in trust, self-assessed AI competencies, usage practices and the ability to benefit meaningfully from AI-supported learning.

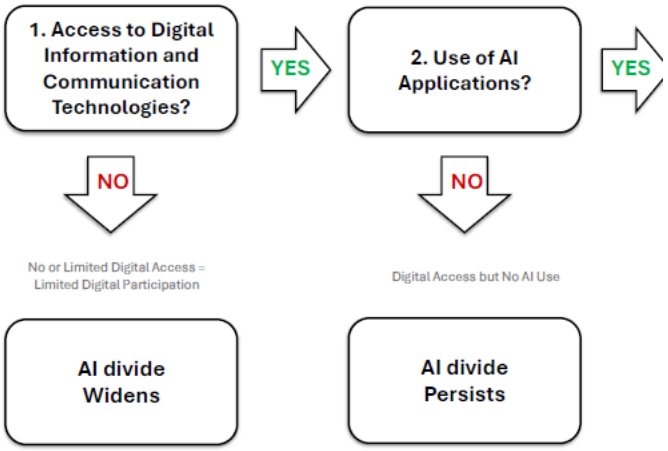

Figure . *AI Divide: Cumulative Logic*

Operational AI readiness in higher education offers a useful analytical heuristic for this problem. It does not simply ask whether AI is available, but whether learners are prepared to use AI reflectively, critically, and in a learning-oriented way for academic work. In this paper, operational AI readiness is aligned with subject-related readiness in the sense of readiness to engage with digital, intelligent technologies (Stützer et al., 2023). It is not a static state but a dynamic, multidimensional process that includes acceptance, trust, competencies, and use. Accordingly, operational AI readiness is best understood as a process of becoming ready and willing to use AI in learning-relevant ways (Diren & Horzum, 2022; Holmström, 2022;). This makes it clear that technical or physical access to AI alone is not sufficient to use AI in ways that meet one's specific (academic) needs. Rather, operational AI readiness highlights the importance of being able to meaningfully integrate AI into learning processes and academic tasks, identify productive use cases for AI applications, and develop the competencies required for their reflectively and critically use (Deja & Kisilowska-Szurmińska, 2026). Similarly, Esposito et al. (2026) argue that AI readiness requires corresponding AI competencies. This underscores that operational AI readiness is not a fixed state but rather an individual, learning-related developmental process that can be fostered through the acquisition of AI competencies. A subject-scientific perspective helps sharpen this understanding. Learning is not merely a reaction to external stimuli; it requires internal reasons and perceived relevance (Holzkamp, 1995). In this sense, operational AI readiness can be interpreted as the link between subjective learning motivation and technological agency. Students need 'good reasons' to engage with AI as a learning object; they also need the competences to do so productively (ibid.). Higher education can support this process by creating learning environments, such as e-learning platforms, in which students can test AI, reflect on its limitations, and develop reflective trust (Stützer et al., 2023; Rosemann et al., 2026). To make operational AI readiness empirically accessible, this paper uses three heuristic dimensions: *(I) trust in AI*, *(II) self-assessed AI competencies*, and *(III) AI usage*. These dimensions are theoretically and empirically intertwined: Trust affects willingness to engage with AI; competencies influence the ability to evaluate and use AI critically; and patterns of use shape both trust and competence development over time (Rosemann et al., 2026). The three dimensions are not intended as a statistical model for predicting operational AI readiness. Instead, they represent a heuristic framework that facilitates empirical assessments of individuals or groups and supports the derivation of pedagogical implications.

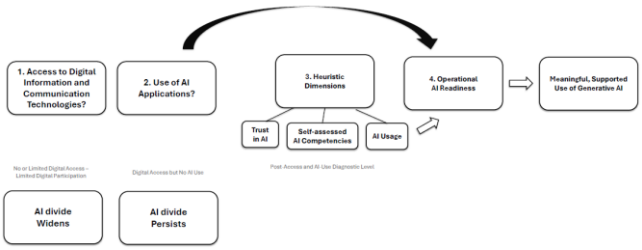

Figure 2. *AI Divide – Expanded Cumulative Logic*

Empirical Example: DigiTaKS* and the Heuristic Dimensions of Operational AI Readiness

To illustrate the heuristic in practice, we draw on a questionnaire study conducted within the DigiTaKS* project. The project aims to foster transformative digital competencies and AI-related competencies among non-technical undergraduate students at a German university. Across successive bachelor cohorts, students received laptops and worked within a standardised software ecosystem, while competence development was tracked through a mixed-methods longitudinal design. The questionnaire was completed by 70 students; after data cleaning, 60 valid cases were included in the statistical analyses. The sample consisted of undergraduate students from the Faculty of Humanities and Social Sciences. Data were collected between late November and mid-December 2023, after the broad public availability of large language models. The study is therefore best understood as an

exploratory empirical example rather than a generalisable population study.

Table 1. *Concise operationalisation of the heuristic dimensions*

Dimension	Source	Scale	Example content
Trust in AI	Kollmann & Civey (2023)	10-point Likert	trust in the accuracy of AI outputs; trust in human-AI communication
Self-assessed AI competencies	Vuorikari et al. (2022)	5-point Likert	prompting, bias recognition, privacy, problem-solving
AI usage	Garrel et al. (2023); modified	yes/no; multiple choice	text generation, summarisation, translation, academic work

Roughly 73% of respondents reported using generative AI applications actively. Because most AI applications were freely available at the time of data collection, non-use appears more likely to reflect motivational barriers such as scepticism, uncertainty, or low perceived relevance than limited technical access. This supports the heuristic logic of the paper: If the main barriers are motivation, confidence, and judgement rather than access, operational AI readiness cannot be captured by availability indicators alone.

1. Trust in AI

Trust is the first dimension of the heuristic. Without a minimum level of trust, students are unlikely to engage with AI applications at all; without reflective trust, engagement may become uncritical and educationally counterproductive (Rosemann et al., 2026). Trust was measured using two items adapted from Kollmann and Civey (2023), assessed on a 10-point Likert scale. The items capture trust in the accuracy of AI-generated outputs and trust in human-AI communication. The descriptive results show moderate trust in the accuracy of AI outputs (M = 5.05; SD = 2.19) and substantially higher trust in communicative interaction with AI (M = 7.41; SD = 2.67). This difference is analytically important: It suggests that students may feel comfortable interacting with generative AI as a conversational partner while remaining more cautious about its epistemic authority. In other words, this may suggest a form of AI use characterized by fluency rather than reflective engagement. That pattern is highly relevant for educational offers respective e-learning platforms, because students may accept interactional ease without sufficiently interrogating factual reliability.

The centrality of trust is not specific to the European context examined here. The African Union (2024, p. 53) explicitly identifies trust-building as a foundational precondition for AI adoption, stating that "ensuring safe and secure AI systems is essential for building public trust in AI", and calling for the development of responsible AI that encompasses transparency, accountability, and risk awareness as conditions for its long-term legitimacy. That two structurally distinct policy frameworks – one addressing individual learners in European higher education, the other addressing AI governance at the continental scale in Africa – independently foreground trust as constitutive of AI readiness supports the argument that trust is a structurally dimension rather than a context-specific artefact. The cross-contextual convergence strengthens the heuristic's generalisability, while the differing institutional logics through which trust is addressed – individual learner scaffolding in Europe, systemic governance frameworks in Africa –underscore the importance of context-sensitive operationalisation. This cross-contextual convergence does not imply identical institutional logics, but it does suggest that trust is a structurally relevant dimension of AI readiness across contexts.

2. Self-assessed AI competencies

Self-assessed AI competencies form the second dimension of the heuristic. In this context, AI competencies serve a key function, as they can be intentionally developed through teaching and learning environments (e. g. e-learning platforms) in higher education, whether delivered in digital or face-to-face formats. AI competencies comprise the knowledge, skills, and attitudes needed to use AI applications confidently, critically, and responsibly (Vuorikari et al., 2022). The questionnaire drew on DigComp 2.2 (ibid.) and included items covering information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. The data from the project DigiTaKS* indicate a differentiated profile. Students rated their awareness of the controversial use of AI in relation to their own performance relatively highly (M = 4.42; SD = 0.97), as well as their understanding of the rapidly evolving and uncertain nature of AI (M = 4.31; SD = 1.07). They also felt reasonably familiar with practical areas of AI use (M = 4.15; SD = 1.14). However, self-assessed competence was lower for prompting (M = 3.63; SD = 1.02), and for generating and critically using AI content (M = 3.64; SD = 1.34). Awareness of bias (M = 3.81; SD = 1.22) and data protection risks (M = 3.98; SD = 1.21) was also only moderate. Heterogene gruppe, bei der sich die Befragten deutlich in ihrer Einschätzung unterscheiden. The standard deviations indicate a heterogeneous distribution of self-assessments. This variability is particularly pronounced for application-oriented competencies, such as prompting and the generation and critical evaluation of AI-generated content. Consequently, students differ considerably in these areas with regard to their perceived competencies. One possible explanation for these differences could be variations in prior experience with

AI, as well as differing learning opportunities across formal, non-formal, and informal learning contexts.

The AU framework equally identifies AI competencies as strategically central, but frames them differently: Where the European framework DigComp 2.2 targets individual citizens' everyday interactions with digital technologies, the AU addresses competence development as a macro-structural capacity agenda. It calls for member states to "[p]romote diversity in AI skills and AI talent to prepare Africa's workforce of tomorrow" (AU, 2024, p. 29) and to "[s]upport AU Member States to develop national AI competencies for teachers and students" (ibid., p. 40), encompassing transversal skills including "complex problem-solving, critical thinking, creativity and design, collaboration and team-building, social intelligence, and cross-cultural competencies" (ibid., pp. 46 f.) This contrast is analytically productive, because it demonstrates that self-assessed AI competence is a structurally dimension of operational AI readiness across contexts, while its operationalisation have to be reflective to the specific institutional and sociocultural framework. The DigComp 2.2-derived items are suited to the European setting; future applications in African higher education would require instruments adapted to local pedagogical traditions, digital infrastructure conditions, and the AU's emphasis on collective and cross-cultural competencies. For the present paper, the important point is that AI competence has to be operationalised in ways that are sensitive to institutional, linguistic, and infrastructural contexts.

3. AI usage

AI usage patterns constitute the third dimension of the heuristic. While trust captures the affective precondition for engagement and self-assessed competence captures the cognitive architecture, usage shows how operational AI readiness is enacted in concrete academic practice. However, AI usage was measured through a dichotomous item and a list of application domains (Garrel et al., 2023). The results show that students use AI primarily for receptive and knowledge-oriented purposes: initial information search (82%), clarification of conceptual questions (75%), and text summarization (73%). More productive or transformative uses are less frequent, although still substantial: text generation (66%), support for academic tasks (50%), spelling and grammar correction (43%). Uses requiring higher levels of judgement or personal responsibility are less common, such as decision support (21%) or organization and planning (11%). The results indicate that students primarily use AI receptively as a tool for information gathering and structuring knowledge. This is most commonly applied to preliminary research, clarifying technical terms, and summarizing texts. The AI usage scores indicate that receptive forms of use predominate, whereas productive and interactive activities—such as collaborative knowledge production—occur considerably less frequently. Nevertheless, around two-thirds of students use AI to draft texts, and half employ it for academic tasks. The relatively infrequent use of AI for decision-making and personal planning suggests a conscious level of critical reflection. This restraint reflects a well-developed evaluative competence, as students continue to trust human interaction for sensitive processes.

Synthesis: A Heuristic Model of Operational AI Readiness

Overall, it can be concluded that while the student body has naturally integrated AI into their daily learning routines respective academic work, they have yet to fully tap into its potential for collaborative and creative processes. Operational AI readiness is shaped by the interrelated dynamics of trust, AI competencies and usage, and extends beyond simple confidence in technology to the ability to critically evaluate AI systems in terms of benefits, limitations, and risks. It is strengthened through AI competencies, informed and transparent engagement with underlying systems, and institutional guidance that defines appropriate and context-sensitive use, enabling a shift from reliance on trust toward more stable competence- and safety-based understanding. Higher education institutions can promote operational AI readiness by providing structured opportunities for both formal and non-formal AI use while fostering critical and reflective engagement, thereby supporting the development of competent, context-aware users. At the same time, operational AI readiness is shaped by broader social inequalities, as the digital divide reflects uneven access to participation and learning opportunities rather than merely infrastructural access, creating the risk that unequal competence development may reinforce educational disparities in higher education.

Taken together, trust in AI, self-assessed AI competencies, and AI usage constitute the empirical architecture of the heuristic model proposed in this paper. In educational contexts, this dimension cannot be examined in isolation: trust shapes the willingness to engage with AI tools; perceived competencies influence the ability to evaluate their outputs critically; and recurring usage experiences continuously reinforce or attenuate trust perceptions over time (Schönmann & Uhl, 2023, p. 435 f.). These interdependencies are central to the logic of the heuristic: trust does not precede competence and usage as a fixed prior condition, but co-evolves with them through situated practice. This is precisely why higher education — as a structured environment for guided, reflective experience — is the appropriate institutional site for developing reflective trust: students can test AI outputs against independent sources, encounter AI failure in low-stakes settings, and progressively refine their ability to judge what AI-generated content can and cannot be

relied upon. The model is not a summative score and not a prediction model; it is an interpretive heuristic. It identifies the constellation of readiness, limitation, and learning need that characterises a given student population.

From Assessment to Competence Development: E-Learning Platform ComDigiS*

Assessing students' trust in AI, AI competencies, and usage patterns serves primarily to identify educational needs rather than being an objective in itself, enabling the design of targeted, competence-oriented learning opportunities. The findings indicate that while many students already use AI tools, their usage is mostly passive and receptive, such as searching for information or summarizing content. There is a clear need to strengthen more advanced competencies, including active and interactive AI use, critical evaluation of AI outputs, and the development of well-founded, reflective trust in AI applications, which represents a key challenge for higher education.

Against this background, ComDigiS* can be understood as a didactic response to the diagnostic perspective developed in this paper. ComDigiS* was developed within the DigiTaKS* project between 2021 and 2024 as an e-learning platform for the development of transformative digital competencies (Schubert et al., 2025). ComDigiS* was enhanced especially for students in the humanities and social sciences, whose study programmes without a technical background, although these competencies are increasingly required in academic, professional and societal contexts (Rosemann et al., 2026). As an Open Educational Ressource-based (OER) learning platform that can be used alongside regular studies, ComDigiS* supports self-regulated and self-directed learning: students can decide when and how they engage with the materials, identify their own strengths and weaknesses, and work on selected competence areas according to their individual needs. Its initial focus was not exclusively on AI, but on a broader understanding of digital competence in higher education. The platform was designed to support students in acquiring competencies – such as AI – that enable them to act confidently, critically and responsibly in digital academic, professional and social contexts. Its structure is based on the European Digital Competence Framework for Citizens (DigComp 2.2), and covers competence areas such as information and data literacy, communication and collaboration, digital content creation, safety and problem solving (Vuorikari et al., 2022; Schubert et al., 2025). The modules follow an inherent structure of cognitive domains: "Understanding", "Applying" and "Evaluating". This structure allows learning units to move beyond the transmission of information by connecting conceptual knowledge with practical application and critical judgement. The existing ComDigiS* structure already includes an initial AI-related element within the module on problem solving, namely a learning unit on the reflected use of new technologies using AI as an example. This earlier integration (approximately published in 2023) shows that AI was already addressed as part of broader digital competence development rather than as an isolated technical topic.



Figure 3. *AI Unit in ComDigiS**

For example, the existing AI-related unit in ComDigiS* addresses in the domain of "understanding", basic definitions, historical developments of AI-technologies, machine learning and algorithmic processes. In the domain of "applying", they engage with possible uses of AI in academic contexts, generative AI applications and creative forms of AI use, while the "reflecting" domain addresses ethical questions, fairness, data protection, work-related implications, current developments, risks and long-term societal consequences.



Figure 4. *What's an Algorithm? Screenshot from ComDigiS**

Even though AI was already included the rapid development and widespread use of generative AI in higher education have created new and more specific competence requirements that go beyond this initial integration. AI is no longer only one example of an emerging technology, but increasingly becomes part of everyday academic practices, including research, writing, feedback, translation, organisation and knowledge production. In the new project phase, which began in 2024, the existing ComDigiS* structure is therefore being extended through a dedicated AI-

related course. This course is currently being developed in close connection with ongoing AI-related research activities within the project, such as the one approach presented in this paper. Its role is not to present a fixed or final curriculum, but to translate emerging research findings on students' AI-related competencies, usage practices and trust into a structured learning opportunity. The diagnostic perspective described in this paper directly informs this development process: the empirical analysis of trust in AI, self-assessed AI competencies and AI usage patterns helps to identify which dimensions of operational AI readiness require further pedagogical support.

For example, if students mainly use AI receptively, how our data shoes, learning opportunities should support a progression toward more productive and interactive forms of engagement. If self-assessed competencies are stronger in understanding than in applying or evaluating, learning activities should not stop at explaining what AI is, but should also foster practical strategies for use and critical judgement of outputs. If students show communicative openness toward AI while remaining uncertain about its epistemic reliability, learning settings should support the development of calibrated trust. In this way, the heuristic dimensions — trust in AI, self-assessed AI competencies and AI usage patterns — can inform the design of pedagogical interventions. Our e-learning platforms thus becomes a didactic space in which concepts like "operational AI readiness" can be actively supported.

In this sense, ComDigiS* is not presented as a universal solution, but as an example of how higher education institutions can connect empirical assessment with structured competence development. Its relevance lies in the connection between diagnosis and development: AI-related competencies, usage practices and trust are first made visible through empirical analysis and are then addressed through learning opportunities that support understanding, applying and evaluating AI in academic contexts in a purposeful, critical and reflective way.

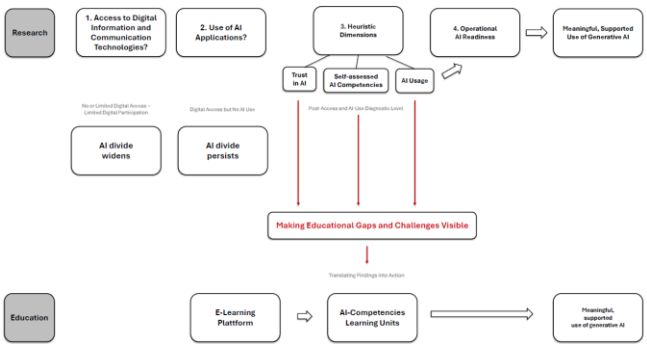

Figure 5. *AI Divide and Operational AI Readiness in terms of Education*

The OER of ComDigiS* is also important for the broader argument of this paper. Open and modular learning materials can be reused, adapted and further developed for different institutional and educational contexts. This is particularly relevant because AI competence requirements are changing rapidly and differ across disciplines, institutions and regions. The AI-related course should therefore not be understood as an adaptable educational response that can be revised in relation to new empirical findings, technological developments and contextual needs. This prepares the following section, which discusses how such an approach can be adapted to different educational contexts rather than directly transferred from one institutional setting to another.

Context-Sensitive Adaptation of the Heuristic

The approach presented in this paper is grounded in a European higher education context and illustrated through empirical findings from the DigiTaKS* project. It is therefore not proposed as a model that can simply be transferred to other educational systems without modification. Following the cumulative logic of the digital and AI divide, access to digital devices, internet connectivity and AI applications remains a fundamental precondition for participation. In many European higher-education contexts, and particularly in the German context examined here, this first level of access can largely be assumed, even though regional and institutional differences persist. In the DigiTaKS* project, the access dimension was additionally addressed by providing students with laptops and a standardised software ecosystem. The present paper therefore focuses on a subsequent level of the AI divide: differences in how much they trust them, how they assess their own AI-related competencies as well as whether and how students use AI applications. For a context-sensitive adaptation of the heuristic, this presupposition must be made explicit. In contexts where digital access is unevenly distributed, infrastructure and connectivity remain the first level of the AI divide. In contexts where access can largely be assumed, the focus can shift toward the competence-related dimensions addressed in this paper: trust in AI, self-assessed AI competencies and AI usage patterns.

This also becomes visible in European competence frameworks such as DigComp 2.2. The framework conceptualizes AI respective digital competence primarily at the level of individual knowledge, skills and attitudes. This is useful for analyzing how learners search for information, communicate, create digital content, protect data and solve problems in digital spaces. At the same time, such a framework implicitly presupposes a basic level of access to digital devices, internet connectivity and digital learning environments. In the context of AI, this means that DigComp 2.2 is particularly relevant for post-access questions: how learners use AI applications, how they evaluate AI-generated outputs, how they protect data and how they

integrate digital and AI-based tools into learning and work practices.

This perspective is especially relevant for contexts beyond Europe, including African higher education systems. At the macro level, the AU similarly conceptualises AI as a transformative and multifunctional technology that is increasingly shaping education, health, agriculture, governance, and other societal sectors (AU, 2024). Importantly, the AU's strategic vision extends beyond mere access to AI technologies and emphasises the development of human capacities, digital competencies, responsible use, and governance mechanisms that enable individuals and institutions to benefit from AI in meaningful ways. Whereas the AU's perspective focuses on the societal and institutional conditions necessary for AI-driven transformation, the heuristic model captures how these ambitions are reflected in the everyday practices of individual learners in higher education.

In the course of developing this paper, we also considered the AU's Continental Artificial Intelligence Strategy as a relevant policy document for reflecting on context-sensitive adaptation beyond the European higher education context. The strategy should not be understood as an equivalent to European competence frameworks such as DigComp 2.2. Rather, while DigComp 2.2 primarily supports the operationalization of individual digital competences, the AU strategy addresses AI at a broader macro- and meso-level by focusing on capacity building, responsible AI governance, infrastructure, institutional development and the role of AI in societal transformation.

A context-sensitive adaptation of the heuristic would therefore proceed in several steps. First, local learning practices, institutional requirements and infrastructural conditions need to be identified. Second, the heuristic dimensions — trust in AI, self-assessed AI competencies and AI usage patterns — should be reviewed and, where necessary, adapted to the respective educational context. Third, the empirical instrument and the learning materials need to be translated, culturally contextualized and aligned with local pedagogical practices. Based on the resulting findings, competence-oriented learning modules can then be designed or revised and evaluated iteratively. Such an approach requires collaboration with local stakeholders, who are the experts of their own educational, institutional and cultural contexts. Rather than transferring a model from one region to another, the aim is to create a process of mutual learning in which researchers and practitioners can adapt, question and further develop the heuristic together. In this way, the approach remains empirically grounded while allowing institutions to develop locally meaningful responses to the AI divide.

DISCUSSION & CONCLUSION

The AI divide is not a temporary asymmetry that will disappear as AI applications become more widely available. Rather, it is a structural educational challenge that persists at the levels of competence, trust and meaningful use, even when basic access barriers are reduced. For higher education, this means that the question is not only whether students have access to AI applications, but whether they are able and willing to use them in purposeful, critical and reflective ways.

This paper has proposed operational AI readiness as a heuristic lens for understanding this challenge. Building on the concept of operational AI readiness and the broader discussion of the digital and AI divide, the paper has examined trust in AI, self-assessed AI competencies and AI usage patterns as three interrelated dimensions through which students' AI-related readiness can be empirically explored. The empirical example from the DigiTaKS* project shows that students are already active users of AI applications, but that their use remains predominantly receptive and knowledge-oriented. Trust is uneven, with stronger confidence in communicative interaction than in the accuracy of AI-generated outputs, while self-assessed competencies point to further development needs in more applied and evaluative forms of AI use.

These findings underline that AI competence development cannot be left to individual experimentation alone. Higher education institutions need structured learning opportunities that help students move beyond basic or receptive AI use toward more productive, critical and responsible engagement. ComDigiS* was presented as one possible pedagogical response to this challenge. As a modular, OER-based self-learning platform, it connects diagnostic insights with competence-oriented learning opportunities and supports students in developing digital and AI-related competencies alongside their regular studies.

The contribution of this paper is therefore both heuristic and pedagogical. It does not offer a universal model, a fixed questionnaire or a ready-made curriculum. Instead, it proposes a diagnostic-development logic: operational AI readiness can first be made visible through empirical assessment and can then be addressed through adaptable learning opportunities. This logic is particularly relevant for context-sensitive adaptation. In different institutional, regional and cultural settings, including diverse African higher education contexts, the heuristic dimensions, instruments and learning materials would need to be reviewed, localized and further developed in collaboration with local stakeholders.

In this sense, the paper understands operational AI readiness not as a fixed state, but as a developmental process that can be supported through education. Strengthening this readiness is one way in which higher education can contribute to reducing the AI divide: not by assuming that access alone is sufficient, but by

enabling learners to understand, use and critically evaluate AI in relation to their own academic, professional and societal contexts.

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