TE_Reg WP2b Marburg/Germany

Exploratory report on “AI in teacher education”

Current situation and relevant documents

1 National Guidelines

In Germany, the ministries of education of the federal states are responsible for education policy. These ministries play a crucial role in shaping and implementing educational standards and guidelines in the individual federal states.

In 2023, the ministries of education issued guidelines for dealing with Artificial Intelligence (AI), with a particular focus on text generators such as ChatGPT. These developments highlight the importance of engaging with new technologies and regulating their use in the educational sector. The guidelines from Hesse (a) and Bavaria (b) are presented below as examples.

The ministries of education of the federal states coordinate their education policy within the framework of the Standing Conference of Ministers of Education and Culture Affairs (KMK). In 2024, the KMK published a comprehensive guideline for dealing with AI in the education sector (c).

In teacher education, there is a dual challenge: on one hand, future teachers must be prepared to use AI in their professional practice and to develop students' competencies in dealing with AI through their teaching. On the other hand, the educational institution of the teacher training academy must address the legal questions surrounding the use of AI in examinations. In 2024, the ministry developed and published a guideline addressing these issues (d).

1.1 Hessian Ministry of Education (2023): Artificial Intelligence (AI) in School and Teaching. A Guide for Teachers on Dealing with AI-Based Applications.

The document is a guide for educators on integrating AI applications in schools. It discusses AI content generators, their benefits and challenges, pedagogical considerations, legal aspects, and the importance of ethical use. It provides resources for teachers to promote responsible AI implementation and enhance individualized learning experiences.

1.2 Bavarian Ministry of Education (2023): Guidelines for the Use of AI Applications in Schools

The Bavarian Ministry of Education's guidelines emphasize the pedagogical use of AI in classrooms, advocating for its responsible application to enhance educational outcomes. Educators are encouraged to critically assess AI tools for their effectiveness and reliability while ensuring compliance with data protection regulations. The guidelines highlight the importance of fostering ethical awareness among students regarding the implications of AI technologies. Additionally, teachers are urged to integrate AI in a way that promotes critical thinking, creativity, and collaboration among students. By doing so, the ministry aims to prepare students for a future where AI plays a significant role in society.

1.3 Conference of Ministers of Education (2024): Recommendations for Educational Administration on Dealing with Artificial Intelligence in Educational Processes

The document provides recommendations for educational administration on integrating artificial intelligence (AI) in education. It emphasizes understanding AI's impact on learning, modernizing assessment formats, professionalizing teacher training, establishing regulatory frameworks, and ensuring equitable access to AI technologies to enhance educational outcomes while addressing ethical concerns.

1.4 Hessian Teachers‘ Academy (2024): The Use of AI Tools in Teacher Training

The document discusses the integration of AI tools in teacher education, highlighting their potential to enhance efficiency and support lesson planning. It addresses challenges like content evaluation and ethical concerns, emphasizing the need for responsible usage and training for educators to adapt AI effectively in educational contexts.

2 Cyber security / GDPR

In Germany, the requirements for data protection concerning AI applications in schools are very high. Without the consent of the legal guardians or the adult students, no personal data may be published at schools. Additionally, students cannot be required to register on online platforms.

Since education in Germany must generally be free of charge, it is only possible to use paid services with the consent of the parents. This situation presents teachers with the challenge of finding data protection-compliant offerings for AI applications in schools while simultaneously securing financing.

One example that illustrates this problem is the platform fobizz. This platform aims to provide teachers with resources and tools for digital education, including AI applications with stringent data protection.

Despite the clear advantages of using fobizz and similar platforms, many schools face significant barriers when it comes to acquiring the necessary licenses. One of the most pressing issues is the lack of funding from the Kultusministerien (Ministries of Education). While there is a growing recognition of the importance of digital education, financial support for schools to purchase licenses for platforms like fobizz is often inadequate or nonexistent.

This lack of funding creates a disparity in access to quality educational resources. Schools in wealthier districts may have the means to invest in such platforms, while those in underprivileged areas struggle to provide their educators with the tools they need. As a result, students in less affluent regions are deprived of the same opportunities for learning and growth as their peers elsewhere.

3 What is going on in education?

This chapter provides a comprehensive overview of the role of Artificial Intelligence (AI) in education through three distinct parts. Part 1 presents an overarching model that outlines the dimensions in which AI can be significant in the classroom. Part 2 introduces competency models related

to the use of AI in teaching, emphasizing the skills educators need to effectively integrate these technologies. Finally, Part 3 illustrates a practical example of recommended application areas for teachers, as highlighted in current pedagogical literature. Together, these sections aim to illuminate how AI is influencing educational practices and shaping the future of teaching and learning.

3.1 Falk Joscha (2023): A Framework for Teaching AI. Five Dimensions of Learning “despite, with, about, through and without AI”

Joscha Falck distinguishes five approaches to dealing with Artificial Intelligence (AI) in classroom education.

Firstly, it emphasizes using AI as a tool to support the learning process. Teachers can employ AI-driven applications to create personalized learning experiences and provide individual feedback to students.

The second approach focuses on critically engaging with AI. Students should learn to understand how AI works and discuss its advantages and disadvantages, fostering awareness of ethical issues and the societal impacts of AI.

The third approach addresses the creative use of AI. Students can leverage AI to develop their projects, particularly in fields like art or music, stimulating creativity and demonstrating how AI can act as a partner in the creative process.

The fourth approach involves developing AI competencies. Students should acquire basic programming skills and understand how AI systems operate.

Finally, the importance of collaboration between teachers, students, and AI is highlighted to create an effective learning environment. Combining these approaches can help make education future-ready.

3.2 Expanding the curricula with AI-specific skills

3.2.1 Torrau, Sören/Köhler, Florian (2024): Digitale Quellen im Politikunterricht entdecken.

In their article "Discovering Digital Sources in Political Education," Sören Torrau and Florian Köhler emphasize the necessity of fostering competencies in dealing with Artificial Intelligence (AI) within the school context. They argue that students should not only acquire technical skills but also develop a critical awareness of how AI functions and its impacts.

A central point is the analysis and evaluation of digital sources. Students should learn to question information from AI-driven systems and assess its credibility. This includes the ability to distinguish between reliable and unreliable information.

Furthermore, the importance of media literacy is highlighted, enabling students to engage with digital content actively and responsibly. To achieve this, the authors suggest several didactic concepts, such as project-based learning, where students work on real-world problems involving AI, and inquiry-based learning, which encourages them to ask questions and seek answers about the role of AI in society. They also recommend integrating collaborative learning approaches, allowing

students to work together to analyze digital sources critically. These methods aim to equip students with the necessary skills to navigate the complexities of AI in the digital age.

3.2.2 Huwer, J. et al. (2024): Kompetenzen für den Unterricht mit und über Künstliche Intelligenz in den Naturwissenschaften: DiKoLAN^{KI}.

The authors present in their article titled "Competencies for Teaching with and about Artificial Intelligence in the Natural Sciences" a competency model that is based on the general competency model DiKoLAN (Digital Competencies for University Teacher Education in the Natural Sciences), which has been expanded to address the phenomenon of Artificial Intelligence (AI). It discusses the integration of AI competencies into teacher education, particularly in the natural sciences.

The article emphasizes that AI is no longer a future concept but is already prevalent in various sectors, including everyday life and scientific research. The rapid adoption of generative AI systems, such as ChatGPT, highlights the need for educators to develop AI-related skills to fulfill their educational responsibilities.

The authors argue that the acquisition of AI competencies should be a cross-disciplinary task, necessitating that all teachers possess both general and subject-specific AI skills. The article also stresses the importance of professional development for educators, ensuring they are equipped with the necessary technological, pedagogical, and didactic competencies.

Furthermore, it points out that the educational system must adapt quickly to these technological advancements, with a focus on collaboration between educational research and teacher training institutions. The article concludes that the integration of AI into teacher training is crucial for preparing educators to effectively use AI in their teaching practices, thereby enhancing the learning experience for students in the natural sciences.

The article outlines several key competency areas essential for integrating AI into teacher education, particularly in the natural sciences. These areas include:

1. Assessment, Feedback, and Adaptivity (AFA): This area focuses on using AI tools for formative assessments, providing personalized feedback, and adapting learning processes to meet individual student needs.

2. Documentation (DO): Emphasizes the importance of systematic documentation of learning and development processes, utilizing AI for data collection and analysis.

3. Presentation (P): Involves the ability to use digital media effectively for communication and visualization of scientific concepts, supported by AI tools for enhanced presentations.

4. Communication and Collaboration (KK): Highlights the role of AI in facilitating communication and collaborative learning experiences, including interactions between humans and machines.

5. Research and Evaluation (RB): Focuses on leveraging AI for efficient information retrieval, assessment of sources, and critical evaluation of data.

6. Measurement and Data Collection (MD): Addresses the use of AI technologies for accurate data collection and analysis in scientific contexts.

7. Data Processing (DV): Involves the application of AI algorithms to process and analyze large datasets, recognizing patterns and making predictions.

8. Simulation and Modeling (SM): Highlights the use of AI in creating simulations and models to enhance understanding of complex scientific phenomena.

3.3 Guidelines for Teachers: Effectively Utilizing AI in Education

The book "Successfully Teaching with Artificial Intelligence - Useful Tools for Everyday School Life" exemplifies a wealth of pedagogical literature that offers practical tips for integrating AI into education.

In the section on lesson preparation, the book discusses various AI tools that can save time and effort for teachers. It covers generating teaching materials such as subject-specific texts, error-filled texts for correction exercises, summaries, gap-fill exercises, translations, and differentiated texts. Additionally, it highlights the creation of detailed task solutions, experimental protocols, quizzes, role cards, presentations, audio texts, videos, and feedback collection, along with planning instructional sequences and learning plans.

During lesson execution, the book focuses on motivating students through AI-enhanced activities. It suggests facilitating writing conversations, composing and revising texts, generating creative writing ideas, conducting group puzzles, assessing problem-solving methods, providing learning aids, working with images, and actively engaging vocabulary development.

In the lesson follow-up section, the book emphasizes relieving teachers' workloads. It discusses evaluating student performance, correcting texts, checking for AI-generated content, creating recommendations for pedagogical measures, and saving time on administrative tasks.

Finally, the book reflects on the role of AI in education, providing pedagogical tips for discussing AI in the classroom, preparing students for future job markets, and rethinking assessment and ethical considerations related to AI.

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