AI in Higher Education: Analysis of Relevant Practices and Their Potential for Green Transition

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Artificial Intelligence (AI) has the potential to significantly impact the entire spectrum of sustainable development by targeting the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. In the present study, we analysed reports from university teachers on 26 practises of AI implementation in pedagogical processes at nine faculties of the University of Ljubljana that responded to a call for participation in the Artificial Intelligence in Education project at the University of Ljubljana (2023–2024). We found that various AI tools were mainly used to facilitate the achievement of the sustainable development pillars Economy (SDG9, SDG12) and Society (SDG4) in different areas of KLASIUS-P educational activities, other SDGs were addressed to a lesser extent. Based on the results, we can conclude that the integration of AI into the pedagogical process has great potential but needs to be supported by regulatory insights and monitoring of AI-based technologies to enable sustainable development.

Keywords: sustainable development goals (SDGs), artificial intelligence in education (AIEd), higher education (HE)

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Introduction

The conceptualisation and operationalisation of sustainability as a global imperative has undergone a significant paradigm shift, catalysed by the formulation of the 17 Sustainable Development Goals (SDGs) and the associated 169 targets ratified by the United Nations in the 2030 Agenda for Sustainable Development (United Nations, 2015). This multi-layered framework has led to an unprecedented focus on the principles of sustainability across different disciplines and sectors. The SDGs represent a comprehensive, integrated approach to tackling complex global challenges and mark the transition from siloed interventions to a more holistic understanding of sustainable development (Bexell & Jönsson, 2017; Mensah, 2019). The adoption of the 2030 Agenda in conjunction with the Paris Climate Agreement represents a turning

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point in global sustainability governance, as this dual framework creates a comprehensive paradigm for both national implementation and international cooperation on sustainable development initiatives that require profound changes in governments, civil society, science and business (Bocken et al., 2016; Sachs et al., 2019, 2021). Its far-reaching impact can already be seen in its integration into national development plans, corporate sustainability strategies and research agendas in various disciplines (Rosa et al., 2019; Schroeder et al., 2019).

Vinuesa et al. (2020) argues that as artificial intelligence (AI) evolves and integrates into different aspects of society, the economy and governance, its potential to both accelerate and hinder progress towards the realisation of the SDGs becomes increasingly clear. To provide an overview of the general areas of positive and negative impacts of AI, they categorised the SDGs into three groups, corresponding to the three pillars of sustainable development, namely Society pilar (SDG 1-SDG 7, SDG 11, SDG 16), Economy pilar (SDG 8-SDG 10, SDG 12, SDG 17), and Environment pilar (SDG 13-SDG 15). The most positive impacts of AI were identified in Environmental pilar (93%), followed by Society pilar (82%) and Economy pilar (70%). In contrast, the most negative impacts were identified in Society pilar (38%), Economy (33%) and Environment (30%) (Vinuesa et al., 2020).

The usefulness of AI in many areas of sustainable development has sparked interest in exploring its role in higher education. Crompton and Burke's (2023) review of the literature on the use of AI tools in higher education points to the rapid increase in the implementation of AI in higher education, which has been used primarily at the undergraduate and graduate levels for the following purposes: (1) Assessment/Evaluation (e.g. automated assessment, test creation, feedback, review of students' online activities, evaluation of educational resources), (2) Predicting (e.g. academic performance, project topics, dropout, career decisions, innovation ability, etc.), (3) AI Assistant (e.g. virtual agents, chatbot assistance, general assistance), (4) Intelligent Tutoring System (adaptive instructional systems that incorporate the use of AI techniques and pedagogical methods) and (5) Managing Student Learning (e.g. learning analysis, identification of learning patterns, curriculum sequencing, instructional design, analysis of teaching effects, clustering of students' personal characteristics, etc.). Almost 50% of the studies were conducted in the fields of language learning, computer science, management and engineering, while only a few studies were reported in the fields of maths, education, medicine and music (Crompton & Burke, 2023).

As can be seen from the literature reviews on the integration of AI in education, the general role of AI in education has mostly been analysed in terms of supporting learners or teachers, and so far, few studies have aimed to bring together the role of AI in education and its potential to support the Sustainable Development Goals. One contribution to this discourse is the literature review conducted by AlGhamdi (2022), which sought to explore the role of AI in the educational context as a means to promote sustainable development. He suggests that the application of AI in education for sustainability goes beyond mere information resources and practical applications related to environmental, economic and social dimensions because it involves facilitating education, raising awareness and cultivating competences, trends and values that encourage individuals to adopt different viewpoints (AlGhamdi, 2022).

Metod

The successful implementation of sustainable development requires the meaningful integration of modern digital tools across different sectors and areas. The University of Ljubljana has tried to facilitate the integration of digital and green transition through several projects. One of them was the project Artificial intelligence in education at the University of Ljubljana (slo. Uporaba umetne inteligence v izobraževanju na Univerzi v Ljubljani). The project aimed to support the meaningful implementation of AI in the pedagogical process and to facilitate the exchange of best practises in different faculties of the University of Ljubljana. In this paper, we have adopted Vinuesa's definition of AI (Vinuesa et al., 2020, pp. 233) and consider AI to be any software technology with at least one of the following capabilities: perception (e.g. facial recognition), decision making (e.g. medical diagnosis systems), prediction (e.g. weather forecasting), automatic knowledge extraction and pattern recognition from data (e.g. detection of fake news circles in social media), interactive communication (e.g. social robots or chatbots) and logical reasoning (e.g. theory development from premises).

Based on the above-described context, our paper focuses in particular on the use of AI in pedagogical processes in higher education related to facilitating sustainable development through alignment with the 17 SDGs. Two main research questions guiding the research in this paper are:

RQ1: In which areas of educational activities according to the KLASIUS-P classification is AI used as part of the study programmes at the faculties of the University of Ljubljana?

RQ2: How is AI used in specific areas of educational activities according to the KLASIUS-P classification and which SDGs does it target?

At the beginning of 2023, all 26 faculties of the University of Ljubljana were invited to participate in the project *Artificial intelligence in education at the University of Ljubljana*. A total of 54 professors from 13 faculties accepted the invitation in April 2023.

During the project, the university professors were asked to submit their own practical examples of the use of AI in the pedagogical process. By the end of the project in November 2024, a total of 26 practises had been submitted by university teachers from 9 faculties (Faculty of Education, Faculty of Arts, Faculty of Natural Sciences and Engineering, Faculty of Architecture, Biotechnical Faculty, Faculty of Economics and Business, Faculty of Law, Veterinary Faculty, Faculty of Health Sciences).

In order to collect data on the implementation of AI, university professors were asked to document their practises in comprehensive reports. Each report contained detailed information about the use of AI in their courses, including the course name, faculty, programme of study, number of students enrolled, area of educational activity (KLASIUS-P), a description of how AI was integrated, details of the AI tools used, and an assessment of the positive and negative impact of AI on the course. The minimum length of the report was 2 pages and the maximum length was 15 pages.

The 26 collected examples of the use of AI in the pedagogical process were categorised according to the KLASIUS-P classification (Statistični urad Republike Slovenije, 2012). The results of the categorisation are shown in Table 1.

In order to obtain a coherent identification of the SDGs as described in the 2030 Agenda for Sustainable Development (2015) and a classification of the role of AI (Crompton & Burke, 2023) in the reported practices, two researchers separately analysed the 26 reports describing the implementation of AI in the pedagogical process. In this way, a total of 111 pages of reports were analysed independently. To avoid bias, the two researchers agreed on the final identification of the SDGs addressed and the classification of the role of AI implementation in the reports through discussion, reconstruction and agreement, which enabled a 95% inter-rater reliability of the analyzed items.

Results

The results section is organised according to the two research questions that guide this study. The first question provides contextual information about the research, the second one provides analysis on how AI is used in the peda-

Table 1 Total Number of Reported Cases of AI Implementation in Different Areas of Educational Activities (KLASIUS–P).

Areas of educational activities (KLASIUS–P)	Total number of reported practices
KLASIUS–P1: Education sciences and teacher training	4
KLASIUS–P2: Arts and humanities	8
KLASIUS–P3: Social sciences, business, law, and administration	5
KLASIUS–P4: Natural sciences, mathematics, and computer science	2
KLASIUS–P5: Engineering, manufacturing technologies, and construction	4
KLASIUS–P6: Agriculture, forestry, fisheries, and veterinary science	2
KLASIUS–P7: Health and social care	1
KLASIUS–P8: Services	0
Total	26

gogical process at the University of Ljubljana and how the use of AI in education and sustainable development influences each other.

RQ1 In which areas of educational activities according to the KLASIUS-P classification is AI used as part of the study programmes at the faculties of the University of Ljubljana?

The results of the analysis for the first research question show that AI tools are currently being used in various areas of educational activities.

The data presented in Figure 1 shows that AI is used most frequently in KLASIUS-P2 with 8 reported cases, indicating a growing interest in the use of AI tools for tasks such as language processing, content analysis and creative support. The potential of AI to improve both student engagement and educational resources in this traditionally qualitative area may be one reason for its prominent use.

Closely followed by KLASIUS-P3 with 5 reported cases. In these areas, AI is likely to be used to support data-driven research, improve decision-making processes and enable interactive learning experiences.

In the areas KLASIUS-P1 and KLASIUS-P5 there are 4 reported cases each for the use of AI. In the educational sciences, AI can be used to personalise learning, improve instructional methodologies, etc. In engineering, AI tools are suitable for core aspects of these fields, such as creating simulations, modelling and optimising problem-solving skills.

The results also show that KLASIUS-P4 and KLASIUS-P6 each have 2 reported cases of AI implementation. These areas often require complex data analyses and predictions modelling, which can be well supported by AI. However,

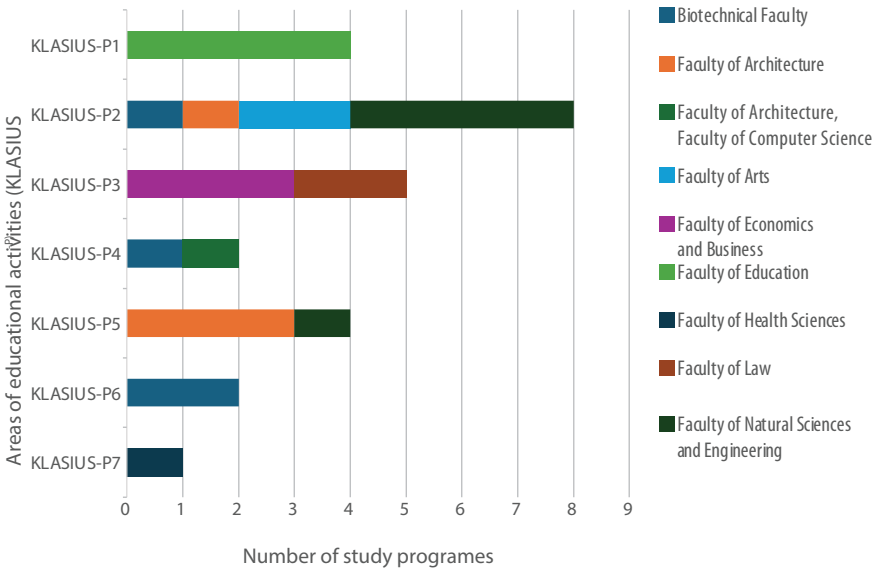

Figure 1 Number of Study Programmes in the Various Faculties of the University of Ljubljana According to the KLASIUS–P Classification.

the relatively low frequency indicates that AI in these areas is still at an early stage or is rather specialised.

Finally, KLASIUS-P7 reported only 1 case of AI use. The use of AI in health education holds great potential but may slow down due to regulatory concerns, ethical considerations and the need for validated results in sensitive environments with humans.

Further details in Table 2 point to the level of study of AI implementation in pedagogical process. More than two-thirds, namely 17 out of 26 reported practices, are integrated in the second study cycle, while 8 reported practices are from the first study cycle. However, it is important to note that the latter varies from faculty to faculty.

RQ2 How is AI used in specific areas of educational activities according to the KLASIUS-P classification and which SDGs does it target?

The analysis of 26 reported practices of AI implementation in the pedagogical process at the University of Ljubljana shows that 11 out of 17 SDGs were targeted. Figure 2 shows that most SDGs are associated with the pillars of Economy (SDGs 8-10, SDG 12, SDG 17) and Society (SDGs 3 - 4, SDG 11, SDG 16) and only rarely with the SDGs related to the Environment (SDG 13, SDG 15).

Table 2 An Overview of the Practices of AI Implementation in the Pedagogical Process as Reported by Professors in Project Artificial intelligence in Education at the University of Ljubljana.

Area of educational activity	Practice Number	Faculty of the University of Ljubljana	Study Level	Study Program
KLASIUS-P1	1	Faculty of Education	1st cycle	Two–subject teacher
	2	Faculty of Education	1st cycle	Two–subject teacher
	20	Faculty of Education	1st cycle	Erasmus (Two–subject teacher, Primary Education, Early Childhood Education, Special and Rehabilitation Pedagogy)
	21	Faculty of Education	1st cycle	Two–subject teacher
KLASIUS-P2	3	Faculty of Arts	2nd cycle	Translation
	4	Faculty of Arts	1st cycle	English studies
	5	Faculty of Natural Sciences and Engineering	2nd cycle	Graphic and interactive communications
	6	Faculty of Natural Sciences and Engineering	2nd cycle	Graphic and interactive communications
	7	Faculty of Natural Sciences and Engineering	2nd cycle	Graphic and interactive communications
	8	Faculty of Architecture	2nd cycle	Master's degree programme in Architecture
	9	Faculty of Natural Sciences and Engineering	2nd cycle	Graphic and Interactive Communications, Graphic and Media Technology
	10	Biotechnical Faculty	1st cycle	Landscape architecture
KLASIUS-P3	11	Faculty of Economics and Business	2nd cycle	Marketing
	12	Faculty of Economics and Business	2nd cycle	Supply chains and logistics
	13	Faculty of Law	1st cycle	Law
	18	Faculty of Law	2nd cycle	Law
	23	Faculty of Economics and Business	2nd cycle	Business Informatics
KLASIUS-P4	14	Faculty of Architecture	2nd cycle	Master's degree programme in Architecture
	24	Biotechnical Faculty	1st cycle	Biotechnology
KLASIUS-P5	15	Faculty of Architecture	2nd cycle	Master's degree programme in Architecture
	19	Faculty of Architecture	2nd cycle	Master's degree programme in Architecture
	25	Faculty of Architecture	2nd cycle	Master's degree programme in Architecture
	26	Faculty of Natural Sciences and Engineering	2nd cycle	Graphic and Interactive Communications, Graphic and Media Technology
KLASIUS-P6	16	Veterinary Faculty	1st cycle	Veterinary
	22	Biotechnical Faculty	2nd cycle	Animal science
KLASIUS-P7	17	Faculty of Health Sciences	2nd cycle	Radiological technology, Physiotherapy

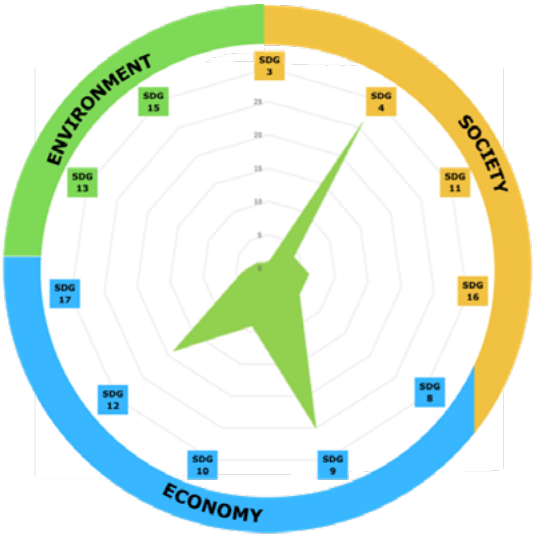

Figure 2 Mapping the Total Number of Targeted SDGs Through the Implementation of AIEd Tools in the Pedagogical Process.

The more detailed analysis following the categorisation of the SDGs using the KLASIUS-P classification indicates differences between the areas of educational activity (Table 3).

The further analysis of the reported practices according to their KLASIUS-P classification, the role of AI in the pedagogical process and the AI tools used is presented in Table 4.

Table 4 shows that in 24 reported practices, the implementation of AIEd tools targeted Society and Economy sustainable development pillars, while in a further two reported practices the Environment pillar was also addressed.

Table 4 shows that among the SDGs that fit into the *pillar Society* of sustainable development, SDG 4 (Quality education) is the most frequently targeted SDG and appears in all 26 reported practices. This shows that AI has great potential to improve the quality of education, provide personalised learning tools and act as an effective assistant for teachers and students. AI tools such as ChatGPT, Midjourney and intelligent tutoring systems are central to changing educational practice. SDG 11 (Sustainable Cities and Communities) and SDG 16 (Peace, Justice and Strong Institutions) are also often supported by the assistance of AI tools. The role of AI in these practices includes improving the quality of education for diverse communities and providing accessible information, which helps to reduce inequalities and promote peaceful, inclusive societies.

Table 3 Presentation of the Reported Practices According to the Targeted SDG Pillars and Areas of Educational Activities (KLASIUS–P).

SDG Pillar	Targeted SDGs	Number of reported practices targeting specific SDGs							
		Total	KLASIUS–P1	KLASIUS–P2	KLASIUS–P3	KLASIUS–P4	KLASIUS–P5	KLASIUS–P6	KLASIUS–P7
Society	SDG 1	0	0	0	0	0	0	0	0
Society	SDG 2	0	0	0	0	0	0	0	0
Society	SDG 3	1	0	0	0	0	0	0	1
Society	SDG 4	26	4	8	5	2	4	2	1
Society	SDG 5	0	0	0	0	0	0	0	0
Society	SDG 6	0	0	0	0	0	0	0	0
Society	SDG 7	0	0	0	0	0	0	0	0
Society	SDG 11	4	0	2	0	0	2	0	0
Society	SDG 16	6	1	2	3	0	0	0	0
	Sum	37	5	12	8	2	6	2	2
Economy	SDG 8	6	0	2	1	2	0	1	0
Economy	SDG 9	25	4	8	4	2	4	2	1
Economy	SDG 10	9	0	2	3	2	1	0	1
Economy	SDG 12	19	4	7	2	0	3	2	1
Economy	SDG 17	4	2	0	0	0	2	0	0
	Sum	63	10	19	10	6	10	5	3
Environment	SDG 13	2	0	1	0	0	1	0	0
Environment	SDG 14	0	0	0	0	0	0	0	0
Environment	SDG 15	1	0	0	0	0	0	1	0
	Sum	3	0	1	0	0	1	1	0
	Total	103	15	32	18	8	17	8	5

The sustainable development *pilar Economy* is the most supported, while SDG 9 (Industry, Innovation and Infrastructure) is the second most targeted goal, especially in areas such as engineering, social sciences and the arts. Tools such as Blender, Midjourney and Teachable Machine are frequently used to support creative activities and promote technological progress. Other SDGs in this pilar, such as SDG 12 (Responsible Consumption and Production) and SDG 10 (Reduced Inequalities), also have significant AI contributions, particularly in the social sciences, engineering and natural sciences. AI tools help to provide assessments, evaluations and innovative production, helping to reduce inequalities and ensure responsible production practices. SDG 8 (Decent Work and Economic Growth) benefits from the role of AI in managing education systems and enhancing skills. For example, AI assists

Table 4 Overview of the Role of AI in the Pedagogical Process in Different Areas of Educational Activities (KLASIUS–P) and its Contribution to the Development of the SDGs.

Area of educational activity	Practice Nº	Role of AI	Used AIEd tools	Targeted SDGs
KLASIUS–P1	1	AI Assistant	Science Activity Generator and ActivGenie	SDG 4 SDG 9 SDG 12 SDG 17
	2	Predicting	Teachable Machine	SDG 4 SDG 9 SDG 12
	20	AI Assistant Managing student learning	WiseCut, Photosonic, Lumen5 in Steve.AI, SongR.ai and Musicgen, D–ID AI Presenter and HeyGen AI, GravityWrite, Elicit, ElevenLabs	SDG 4 SDG 9 SDG 12 SDG 17
	21	AI Assistant	Elicit	SDG 4 SDG 9 SDG 12 SDG 16
KLASIUS–P2	3	AI Assistant	ChatGPT, GPT–4, Google Translate, DeepL	SDG 4 SDG 9 SDG 12 SDG 16
	4	Assessment and evaluation AI Assistant	ChatGPT	SDG 4 SDG 9 SDG 10 SDG 16
	5	AI Assistant	Midjourney	SDG 4 SDG 8 SDG 9 SDG 12
	6	Assessment and evaluation Predicting AI Assistant	expoze.io	SDG 4 SDG 9 SDG 12
	7	Assessment and evaluation AI Assistant	Virtual Caliper, Blender in CLO 3D	SDG 4 SDG 8 SDG 9 SDG 10 SDG 12
	8	Assessment and evaluation AI Assistant	DALL–E, Stable Difussion, and Midjourney	SDG 4 SDG 9 SDG 11 SDG 12
	9	AI Assistant	Blender, Nvidia	SDG 4 SDG 9 SDG 12

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Area of educational activity	Practice Nº	Role of AI	Used AIEd tools	Targeted SDGs
	10	AI Assistant	CHATGPT, Midjourney, DALL–E 2, Stable diffusion, Dream (Wombo)	SDG 4 SDG 9 SDG 11 SDG 12 SDG 13
KLASIUS–P3	11	Assessment and evaluation Predicting AI Assistant Intelligent tutoring system Managing student learning	Mimic Pro Digital Marketing Simternship	SDG 4 SDG 8 SDG 9 SDG 10 SDG 12
	12	Assessment and evaluation AI Assistant Intelligent tutoring system	ChatGPT	SDG 4 SDG 9 SDG 12
	13	Assessment and evaluation AI Assistant	ChatGPT, Grammarly, DeepL	SDG 4 SDG 10 SDG 16
	18	AI Assistant	ChatGPT	SDG 4 SDG 9 SDG 10 SDG 16
	23	Assessment and evaluation Predicting AI Assistant	ChatGPT	SDG 4 SDG 9 SDG 16
KLASIUS–P4	14	Assessment and evaluation AI Assistant Intelligent tutoring system	CodeQ	SDG 4 SDG 8 SDG 9 SDG 10
	24	Assessment and evaluation AI Assistant InstaText		SDG 4 SDG 8 SDG 9 SDG 10
KLASIUS–P5	15	AI Assistant	Midjourney and DALL·E	SDG 4 SDG 9 SDG 11 SDG 12
	19	AI Assistant	Midjourney	SDG 4 SDG 9 SDG 11 SDG 17
	25	AI Assistant	Midjourney and DALL·E	SDG 4 SDG 9 SDG 10 SDG 12

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Area of educational activity	Practice Nº	Role of AI	Used AIEd tools	Targeted SDGs
	26	AI Assistant	Chat GPT, Google bard, ChatSonic, Claude, Learnt.ai and similar, Dall E, NightCafe, Images.ai and similar.	SDG 4 SDG 9 SDG 12 SDG 13 SDG 17
KLASIUS–P6	16	Assessment and evaluation AI Assistant Intelligent tutoring system	Coursera	SDG 4 SDG 8 SDG 9 SDG 12
	22	Predicting	A dairy cattle breeding simulation program	SDG 4 SDG 9 SDG 12 SDG 15
KLASIUS–P7	17	AI Assistant	OpenCV, neural networks CNN (VGG16, VGG19, ALEXNET or similar), Tensorflow in Keras	SDG 3 SDG 4 SDG 9 SDG 10 SDG 12

in the provision of practical training simulations, such as the Mimic Pro Digital Marketing Simternship. SDG 17 (Partnerships for the Goals), although less common, involves AI fostering collaboration and knowledge sharing, particularly within the education community, to collectively achieve the SDGs (Table 4).

The sustainable development *pilar Environment* is least targeted by the AI implementations, whereby SDG 13 (Climate Action) and SDG 15 (Life on Land) are supported to a limited extent. SDG 13 is supported in cases where AI is used creatively and innovatively to raise awareness or mitigate the effects of climate change through visualisation tools such as Midjourney and DALL-E. SDG 15 was targeted only once, indicating a gap in the promotion of environmental sustainability through AI, particularly in areas such as biodiversity conservation and sustainable land use (Table 4).

The integration of artificial intelligence (AI) in diverse educational areas, as classified by KLASIUS-P, emphasizes the multi-layered role of AI tools and their contribution to achieving the SDGs, as shown in Table 4:

– In the area of *Education Sciences and Teacher Training* (KLASIUS-P1), AI functions primarily as an instructional aid through applications such as Science Activity Generator, ActivGenie and WiseCut. These tools facilitate the management of student learning, and the creation of edu-

cational content aimed primarily at SDG 4, SDG 9, SDG 12 and SDG 17, which are about quality education, innovation and sustainable development practices.

- In the field of *Arts and Humanities* (KLASIUS-P2), AI plays a central role in content creation and evaluation processes. Tools such as ChatGPT, Google Translate, DeepL and Midjourney are used to improve creative outcomes and assessment capabilities. Targeted SDGs in this context include SDG 4, SDG 8, SDG 9, SDG 10, SDG 11, SDG 12, SDG 13 and SDG 16, demonstrating that AI not only contributes to improving the quality of education, but also to reducing inequalities, fostering sustainable communities and ensuring responsible consumption and production.
- In the area of *Social Sciences, Business, Law, and Administration* (KLASIUS-P3), AI technologies such as ChatGPT, Grammarly and Mimic Pro Digital Marketing Simternship are used for assessment, learning management and skills development. The SDGs primarily addressed here include SDG 4, SDG 8, SDG 9, SDG 10, SDG 12 and SDG 16, emphasising the role of AI in promoting quality education, supporting inclusive economic growth and enhancing effective governance and institutional efficiency.
- For *Natural Sciences, Mathematics, and Computer Science* (KLASIUS-P4), AI tools such as CodeQ are used in both reported practices to improve the assessment and evaluation of teaching. These applications contribute to SDG 4, SDG 8, SDG 9 and SDG 10 by emphasising the importance of quality education, equitable work opportunities and the reduction of social inequalities through AI-driven education.
- In *Engineering, Manufacturing Technologies and Construction* (KLASIUS-P5), AI tools such as Midjourney and DALL-E are widely used for creative content creation and design processes. These activities are in line with SDG 4, SDG 9, SDG 10, SDG 11, SDG 12, SDG 13 and SDG 17 and reflect the commitment to quality education, sustainable infrastructure development and proactive climate action.
- In the field of *Agriculture, Forestry, Fisheries, and Veterinary Sciences* (KLASIUS-P6), AI is applied in educational simulations in both reported cases, including in dairy cattle breeding programmes targeting SDG 4, SDG 8, SDG 9, SDG 12 and SDG 15. These efforts emphasise the importance of AI in promoting quality education, sustainable agricultural practices and responsible resource management.
- In a reported practice from the area *Health and Social Care* (KLASIUS-P7), AI applications such as TensorFlow and OpenCV are used to support

health-related educational activities, addressing SDG 3, SDG 4, SDG 9, SDG 10 and SDG 12. This integration emphasises the improvement of health and well-being alongside quality educational outcomes through the use of AI-driven technologies.

- The *role of AI in higher education* outlined in Table 4 emphasises its transformative ability to promote the achievement of the SDGs:
- In the context of an *AI Assistant* (e.g. practice No 1, 3, 5, 9, 10, 13, 15, 17, 19, 26), tools such as ChatGPT, MidJourney and DALL-E enhance creative exploration (SDG 4) and promote innovation through personalised support and adaptive learning resources. These features enable inclusive education by tailoring learning experiences to learners' individual needs, fostering creativity and problem-solving skills.
- In the context of *predictive analytics* (e.g. practice No 2, 6, 11, 22, 23), tools such as Teachable Machine use data-driven insights to enable educators to recognise patterns and learning gaps to support quality education (SDG 4) and contribute to industrial innovation (SDG 9). Predictive AI technologies enable educators to proactively address students' needs and create an inclusive and equitable learning environment that enables sustainable educational progress.
- In terms of *assessment and evaluation* (e.g. practice No 4, 7, 8, 12, 13, 14, 16, 24), Intelligent Tutoring Systems and platforms such as Coursera improve inclusivity (SDG 10) by adapting content for diverse learner populations. They also empower educators with real-time feedback, promoting sustainable educational practices (SDG 12). These AI tools improve the effectiveness of assessments by facilitating personalized learning pathways that ultimately benefit both students and teachers.
- Tools such as MidJourney and Blender used in *managing student learning* (e.g. practice No 11, 20) expand the potential for creating immersive and engaging educational content, fostering creativity (SDG 8) and enhancing industry standards (SDG 9). AI-driven learning management tools enable collaborative content development and actively engage learners, enhancing the overall educational experience.
- Finally, the integration of AI into *learning tools* such as WiseCut and Photosonic (e.g. practice N° 20, 26) facilitates multidimensional collaboration (SDG 17) by streamlining content creation and enhancing global communication. These examples show how AI applications in education contribute to progress on multiple SDGs by fostering innovation, inclusivity and sustainability.

Conclusions

The results show that the integration of AI into the pedagogical process is very different in the various disciplines. We found that the reported practices on the implementation of AI in the pedagogical process at the University of Ljubljana cover all KLASIUS-P areas, except for the area of services (KLASIUS-P8), which differs from the results of other studies (e.g., Crompton & Burke, 2023), which indicate that educators integrate AI primarily in disciplines such as language learning, computer science, management and engineering, while relatively few cases are reported from the fields of mathematics, education, medicine and music.

The analysis emphasises the significant role of AI in supporting the SDGs, particularly those related to education and innovation, under the Society and Economy pillars. However, to achieve a holistic impact on sustainable development, more emphasis needs to be placed on the Environment pillar. Leveraging AI's potential to address environmental challenges would create a more balanced approach to sustainability and ensure that the benefits of AI are realised in all areas of society, the economy and the environment.

Our study analysed the reports describing the implementation of the AIEd tools. For a deeper understanding of how the SDGs were targeted, it would be useful to extend the study with interviews with university professors. In future studies, it would also be useful to examine the perspective of the targets related to specific SDGs, taking into account both the positive and negative impacts of AI on specific SDGs. It would also be reasonable to complement the study with additional examples of the use of AI in the pedagogical process at the University of Ljubljana or in the Slovenian higher education sector.

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References

AlGhamdi, A. A. (2022). Artificial intelligence in education as a mean to achieve sustainable development in accordance with the pillars of the kingdom's

vision 2030: A systematic review. *International Journal of Higher Education, 11*(4), 80–90.

Bexell, M., & Jönsson, K. (2017). Responsibility and the United Nations' sustainable development goals. *Forum for Development Studies, 44*(1), 13–29.

Bocken, N. M. P., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering, 33*(5), 308–320.

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*(1), 22.

Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action; Literature review. *Cogent Social Sciences, 5*(1), 1653531.

Rosa, P., Sassanelli, C., & Terzi, S. (2019). Towards circular business models: A systematic literature review on classification frameworks and archetypes. *Journal of Cleaner Production, 236,* 117696.

Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., & Woelm, F. (2021). *Sustainable development report 2020: The sustainable development goals and Covid-19 includes the SDG index and dashboards.* Cambridge University Press.

Sachs, J. D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rockström, J. (2019). Six transformations to achieve the sustainable development goals. *Nature Sustainability, 2*(9), 805–814.

Schroeder, P., Anggraeni, K., & Weber, U. (2019). The relevance of circular economy practices to the sustainable development goals. *Journal of Industrial Ecology, 23*(1), 77–95.

Statistični urad Republike Slovenije. (2012). *Klasifikacija področij izobraževalnih aktivnosti/izidov.* https://www.stat.si/Klasje/Klasje/Tabela/5648

United Nations. (2015). *Transforming our world: The 2030 Agenda for sustainable development.* https://sustainabledevelopment.un.org

Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D., Tegmark, M., & Fuso Nerini, F. (2020). The role of artificial intelligence in achieving the sustainable development goals. *Nature Communications, 11*(1), 233–243.

Umetna inteligenca v visokem šolstvu: analiza ustreznih praks in njihovega potenciala za zeleni prehod

Umetna inteligenca (UI) lahko pomembno vpliva na celoten spekter trajnostnega razvoja, saj lahko naslavlja vseh 17 ciljev trajnostnega razvoja *Agende za trajnostni razvoj do leta 2030*. V pričujočem prispevku smo preučili poročila visokošolskih učiteljev o 26 primerih uporabe UI v pedagoškem procesu na de-

vetih članicah Univerze v Ljubljani, ki so se odzvale k sodelovanju v projektu Umetna inteligenca v izobraževanju na Univerzi v Ljubljani (2023–2024). Ugotovili smo, da so različna orodja UI v pedagoškem procesu uporabljena predvsem za doseganje ciljev stebrov trajnostnega razvoja Gospodarstvo (SDG9, SDG12) in Družba (SDG4) na različnih področjih izobraževalnih dejavnosti KLASIUS-P, ostali cilji trajnostnega razvoja pa so naslavljani v manjšem obsegu. Pričujoča raziskava je omejena in obravnava le prakse, o katerih se poroča v okviru projekta. Na podlagi ugotovitev lahko izpeljemo, da vključevanje UI v pedagoški proces ponuja številne možnosti, vendar mora biti njena uporaba podprta z ustreznimi regulativnimi razmisleki in nadzorom nad uporabo orodij UI z namenom omogočenja trajnostnega razvoja.
Ključne besede: cilji trajnostnega razvoja, umetna inteligenca v izobraževanju visokošolsko izobraževanje