AI Literacy for Cultural and Design Studies

Sophie Schauer[a] and Katharina Simbeck[b]
School of Computing, Communication and Business, HTW University of Applied Sciences, Wilhelminenhofstraße 75A, 12459 Berlin, Germany

Keywords: Artificial Intelligence, Cultural Sciences, Design, Higher Education Institutes, AI Literacy.

Abstract: Artificial Intelligence (AI) is applied to an extending number of academic fields, including culture and design. Hence, there is a necessity to incorporate AI competencies in the curricula of cultural and design studies. This paper explores potential points of contact between cultural and design studies, AI technologies, as well as relevant competencies. Through a comprehensive curriculum analysis of two study programs, expert interviews and analysis of sample projects, the paper finds practical connections for the inclusion of AI competencies into culture and design studies. We propose components of AI literacy for students in culture and design programs along the categories of technical understanding, critical appraisal and practical application. The findings contribute to the ongoing discourse on the interdisciplinary use of AI, offering insights into the evolving skill set in the field of culture and design.

1 INTRODUCTION

Artificial Intelligence has impacted various aspects of our daily lives, and its significance is continually growing. In response to this influence, incorporating a fundamental understanding of AI has become integral to Higher Education Institutions' (HEIs) curricula. This necessity goes far beyond courses in computer science and extends into nearly every field of study (Ng et al., 2021). The transformative potential of AI has become apparent, affecting industries, governance, healthcare, arts, and countless other domains. Hence, HEIs recognise the importance of equipping students across diverse disciplines with AI competencies (Laato et al., 2020).

Culture and design, in particular, have experienced a rise in the relevance of AI competencies (Sangüesa and Guersenzvaig, 2019). AI technologies can aid the analysis of cultural artefacts and historical documents and even support the preservation and reconstruction of cultural heritage (CH) (Pavlidis, 2022). The same applies to design studies that use generative AI as a supportive tool during their creative thinking process (Verheijden and Funk, 2023). The use of AI technologies is, however, related to several issues. AI systems have been found to replicate biases (Ntoutsi et al., 2020) and machine learning systems require training on large data sets which leads to ethical and copyright issues (Mehrabi et al., 2021).

As AI continues to evolve and reshape our world, the collaboration between AI, culture and design is set to bring forth novel approaches to understanding and preserving our cultural diversity and innovative design. We argue, that the integration of AI in culture and design study programs not only needs to empower students with the skills to engage with AI effectively but also needs to address issues such as bias, fairness and copyright. In this paper, the integration potential of AI into cultural science and design studies is explored based on two exemplary study programs at a German University of Applied Sciences. A comprehensive analysis of the programs' class descriptions revealed initial connections. This was followed by two expert interviews with lecturers and reviews of projects that gave further insights. The findings are not only pertinent to these specific programs but also offer valuable lessons and considerations for broader applications in culture and design education.

2 STATE OF THE ART

In the evolution of the cultural sector, the integration of modern technology has been a longstanding practice. Since the 1970s, Galleries, Libraries, Archives and Museums (GLAM) have continuously digitised

[a] https://orcid.org/0009-0006-3350-7803
[b] https://orcid.org/0000-0001-6792-461X

Schauer, S. and Simbeck, K.
AI Literacy for Cultural and Design Studies.
DOI: 10.5220/0012609200003693

In *Proceedings of the 16th International Conference on Computer Supported Education (CSEDU 2024) - Volume 2*, pages 39-50
ISBN: 978-989-758-697-2; ISSN: 2184-5026

their collections (Terras et al., 2021). Digitisation strategies play a major role in keeping and distributing the values of arts and heritage by increasing access to broader audiences, supporting preservation and protection, collections development, raising the profile of collections and institutions, and supporting research, education and engagement (Terras et al., 2021).

Technology use has also increased in the creative industries. Abbasi et al. (2017) state that this has led to the emergence of several trends. One trend, among others, is new forms of artistic expression and novel art genres that have evolved. They further say that fresh perspectives on creativity are seen in museums, theatres and galleries, along with innovative materials, processes and tools for creative practices and different approaches to marketing and selling creative products and services.

2.1 Digitalisation and AI in Culture and Design

Different fields of AI are applied in culture and design. Natural language processing (NLP) is an early domain in machine learning. It can include different applications like machine translation, speech recognition and text processing which can be used for historical text translation and transcription (Raina et al., 2022; Sporleder, 2010). Further, AI algorithms could be applied for improved accuracy in image recognition to detect cultural relics (Wang and Li, 2022). While Galleries, Libraries, Archives and Museums are increasingly digitising their extensive collections of cultural heritage, enhancing accessibility through the support of AI technology should be the aim (Sporleder, 2010; Caramiaux, 2020).

AI has impacted the creative and cultural sectors in recent years immensely. In reports commissioned by the European Commission, the European Parliament and a European association the impact of AI in the creative and cultural sectors has been investigated (Amato et al., 2019). Caramaiaux identifies the potential of AI as "a tool for information management and cataloguing digiti[s]ed cultural artefacts". He details two examples where AI has already been used for the digitalisation and management of large data sets. Further, AI gives opportunities for interactively engaging the public with artefacts in cultural institutions through the use of chatbots. Another opportunity regards AI's ability to personalise the visitors' experience, which is motivated by the goal of predicting an exhibition's popularity and therefore helps in saving money and managing resources. This was already successfully executed in a project by the UK's National Gallery, where the future number of visitors is prognosticated based on an exhibition's characteristics (Kulesz, 2020). Lastly, AI holds the potential to "generate content and reflect on existing collections of data" (Caramiaux, 2023). Several projects have illustrated this potential. The Museum of Modern Art in New York commissioned the artist Refik Anadol to train a generative AI model based on a data set of 180,000 art pieces for the museum. The result was a dynamic abstract artwork that has an impact not solely from its visuals but also its demonstration of the potentials residing in machine learning models (Zylinska, 2023; Caramiaux, 2023).

As digitalisation is taking place in all areas of society, including cultural institutions that embrace digital transformations and integrate AI technologies into their practices, challenges in human-AI interaction are arising. With education being affected as well, addressing these challenges is becoming a responsibility of education stakeholders (Schumann et al., 2020).

2.2 AI Literacy

The term AI literacy has been defined by Long and Magerko (2020) "as a set of competencies that enables individuals to evaluate AI technologies critically; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace." They state AI literacy exists within a web of interconnected literacies, which are all beneficial for successful interaction with AI. Digital literacy, the ability to navigate computer interfaces; computational literacy, involving programming skills; and scientific literacy, particularly in machine learning, build the foundation for users but are not obligatory. However, data literacy, "the ability to read, work with, analy[s]e, and argue with data as part of a broader process of inquiry into the world" (D'Ignazio, 2017), is an essential part and shares similar competencies with AI literacy (Long and Magerko, 2020).

Ng et al. (2021) underline the importance of fundamental AI skills for the general public and formulate three main aspects of creating AI literacy: knowing and understanding AI, using and applying AI, evaluating and creating AI. In addition, they emphasised human-centred considerations for promoting awareness and educating individuals to become socially responsible and ethical users of AI. This educational focus goes beyond merely enhancing students' AI skills. It creates key values like "inclusiveness, fairness, accountability, transparency, and ethics" (Ng et al., 2021). By prioritising these principles, the aim is to foster technical proficiency and demonstrate an understanding of the societal implications and ethical dimensions associated with AI technologies.

Several approaches have been published to measure AI competencies. In the study conducted by Laupichler et al. (2023), AI literacy was categorised into the areas of ”Technical Understanding”, ”Critical Appraisal” and ”Practical Application”. Competencies covering the data-driven nature of AI and theoretical understanding of AI are collected as ”Technical Understanding”, whereas ”Critical Appraisal” covers skills for ethically reflecting, evaluating the results of AI applications and managing legal issues. Other competencies relating to AI application examples or recognising ”if a problem in [one's] field can and should be solved with artificial intelligence methods” (Laupichler et al., 2023) are included in ”Practical Application”. They developed a ”scale for the assessment of non-experts' AI literacy” (SNAIL), targeted at people with no prior AI education, the emphasis was on engaging or cooperating with AI rather than creating or developing it.

Further research by Wang et al. (2023) categorised AI literacy into awareness, usage, evaluation and ethics. In this study, ”awareness” refers to users' capability to recognise and understand AI technology when engaging with applications. ”Usage” on the other hand stands for the necessary skills to effectively apply and utilise AI technology for tasks. Their third core construct ”evaluation” involves the ability to analyse, choose, and critically assess AI applications and their outcomes. Lastly, Wang et al. (2023) define ”ethics” as the capability of being aware of the responsibilities and risks linked with AI technology.

The categories proposed by Williams (2023) are similar to the categories suggested by Laupichler et al. (2023). The category ”concepts” could be compared to ”technical understanding” and includes AI background knowledge and interdisciplinary knowledge. In ”practices”, similar to ”practical application”, Williams (2023) mentions skills such as constructing, analysing and communicating about AI. The third part, ”perspectives”, contains (critical) digital literacy, identity and social awareness and is comparable to ”critical appraisal” (Williams, 2023).

A different approach to AI literacy was taken by Faruqe et al. (2021) who proposed different roles related to AI which require different competencies. The first role is described as ”consumer”, ”who uses the output of AI to improve their work or life” (Faruqe et al., 2021). A second role consists of co-workers, who possess a foundational understanding of AI systems and employ the results in their professional tasks. The collaborator works with multiple AI systems to enhance their performance. The fourth role is creators who engage in the developing and testing of novel AI systems and their model (Faruqe et al., 2021).

In the subsequent chapter, the methodology will explore AI competencies specifically for culture and design.

3 METHODOLOGY

The process of identifying relevant AI competencies for students in cultural and design studies was divided into three parts: a comprehensive analysis of two study programs, expert interviews with respective lecturers and an analysis of existing student projects. The analysis was conducted on two specific study programs offered by a German University of Applied Sciences. These programs were chosen as they contain theoretical and practical cultural and design studies, as well as their hold high potential for integrating AI technology.

3.1 Curricula Analysis

For the conduction of the curricula analysis, the overall structure of the two study programs is explained and selected courses are highlighted.

3.1.1 Museology

The first program to be analysed is the museology course[1], which provides students with insights into contemporary museum practices. It equips them with the skills and knowledge needed to engage with the dynamic demands of the modern museum sector and was chosen because of its breadth of classes and application-oriented focus.

In a few fundamental classes, students learn topics such as inventory management, documentation, and essential museum management tools. Additionally, they gain a foundational understanding of art and cultural history, which serves as a valuable contextual backdrop for their work.

Following, students apply their acquired skills in real-world museum settings, gaining hands-on experience. Their education continues by exploring various types of collections and academic disciplines. Moreover, the program emphasises the importance of communication strategies in museum education, innovative exhibition design, public relations, and visitor research.

In specialisation classes, students are required to opt for three courses from a selection that includes Cultural Economy, Publications, Digital Media, Modern Materials, Digitalisation or Provenance Research.

[1] https://museologie.htw-berlin.de/international-en/

This specialisation semester is succeeded by the completion of the Bachelor's thesis.

The analysis of the classes and their description revealed possible connections with AI in several courses. In "Museum Documentation", students learn the theoretical basics of relational database models and standardised data entry formats. Combining these practices with AI fundamentals, such as machine learning and data analysis, could enhance efficiency and accuracy when working with large volumes of data for archival documentation (Colavizza et al., 2021). This could include making use of automated data entries and metadata generation as well as algorithms for the recognition of entities and keywords but also navigating potential bias and fair representation (Lowagie, 2023).

Furthermore, "Curating of Exhibitions" teaches methods for the concept, planning, organisation and production of exhibitions, as well as fostering a critical reflection on these processes. Using AI tools for exhibition planning or curatorial research can help in the creative process but has to be critically assessed at the same time (Jo et al., 2022; Zhao et al., 2020).

In addition, "Visitor Research and Service" aims to provide students with knowledge on the structural organisation of museums as well as methods for empirical visitor research. Combining these practices with AI could help in analysing visitors' behaviour or predicting future trends (Rani et al., 2023). Further, the need for giving visitors personalised exhibition experiences and developing recommender systems through AI has been recognised by museums and should be catered to (Bordoni et al., 2013)

In "Strategies for Digitalisation" students are familiarised with the techniques, methods, and standards for digitising and making collection inventories available online and get acquainted with digitalisation and online presentation strategies, including finding project partners and fundraising. Students should furthermore develop skills for the ethical handling of digital cultural pieces to correctly deal with growing numbers of digitalised cultural collections (Groumpos, 2022; Pansoni et al., 2023).

Moreover, in the module "Inventory Design" students learn the fundamentals and methods of inventorying and documenting museum collections. They can identify important materials and analyse the artistic and craft techniques of museum objects and are capable of handling museum objects professionally, as well as capturing, describing and accessing them. Learning correct preservation techniques in combination with AI technologies could therefore be highly useful (Marchello et al., 2023).

3.1.2 Communication Design

The second study program closely investigated is communication design[2]. This program prepares students for both the practical and technical requirements of a professional career in the media sector. Its goal is to cultivate creative, collaborative and independent designers with a systemic mindset and a sense of responsibility.

The basics of the study course cover design essentials, experimental methods and the historical aspects of crafts such as print typography, illustration and photography.

Once students have acquired foundational knowledge, design workshops are combined with lectures, methodological training and technological education. Within this context, students choose a specialisation to focus on. International experts contribute different perspectives and insights into the latest industry developments and practices through workshops and lectures. Interdisciplinary projects, including collaborations with other university courses, form an integral part of the curriculum.

In two classes on "Technologies", students are introduced to digital tools and software to gain an understanding of programming processes and their use cases in interdisciplinary projects. Focusing also on the transfer of analogue media to digital formats, especially in terms of publishing methods in multimedia fields, such as e-books, film or motion design. Teaching students a basic skill set for digitalisation and transcription through NLP technology could enhance and optimise their work (Piotrowski, 2012).

Multiple classes on "Design Foundations" impart knowledge on design processes and terminology across various design domains, emphasising applying methodological basics to visualise and create products. The competencies span from three-dimensional and plastic design, simple shape, colour and material theories, to typography and assessment of font effects and their application in design projects. These design processes could be combined with generative AI tools to generate ideas and concepts while critically assessing usability as well as conforming to accessibility and inclusivity guidelines (Tholander and Jonsson, 2023).

In "Design Laws and Ethics" students are educated on issues related to the right to one's own words, images and ideas, involving general legal concepts, exploring aspects of protective and usage rights, addressing contract design and considering ethical considerations in communication practices. The focus is on developing awareness of these challenges and lay-

[2]https://kd.htw-berlin.de/international-en/

ing the groundwork for effective communication with experts in the field. Including education on current laws and regulations on AI and AI-generated results will become more unavoidable (Fui-Hoon Nah et al., 2023).

Furthermore, "Presentation and Documentation of Designs" teaches competencies in domain-specific skills for presenting design products and processes, both verbally and visually, stemming from one's design work. Skills and knowledge in two- and three-dimensional representation and documentation of design processes and outcomes are taught to the students and could possibly be combined with AI tools (Tholander and Jonsson, 2023).

Additionally, in "Materials and Sustainability" students learn to recognise and understand the ecological aspects of product development. The different consequences of technological advancements are illustrated and alternative technologies, renewable resources, sustainable materials and products are formulated. Understanding and critically assessing the environmental impacts of technology usage including AI should be highlighted (Van Wynsberghe, 2021).

3.2 Expert Interviews

As a second step expert interviews were conducted with lecturers from the two study programs to gather further insight into the teachings at the university.

3.2.1 Museology

An expert interview with a museology professor gave insights into the teachings. The professor has been an advocate for implementing digitalisation strategies as part of the curriculum for years and emphasised the critical need for students to adapt to evolving digital standards. One of their classes on "Documentation" focuses on the safekeeping of archival documents and artefacts. Documenting these cultural objects often requires specific formatting for the upload to public databases. However, it was expressed that non-standardised data formats are still in use, or various databases that still obtain old data, hindering the seamless exchange of information within the cultural heritage community. Teaching students how to use AI to automatically generate data in the correct format or clean out outdated data could therefore be a great addition to their curriculum, according to the professor.

3.2.2 Communication Design

In an expert interview, a professor from communication design gave an overview of their courses and offered insights into the content and structure of design classes. From their experience, many students already have significant knowledge of AI tools and regularly apply them in their project work. What they usually lack are a deeper understanding of AI functionality and critical reflection on their AI usage and AI-produced results. According to the professor, they are familiar with a variety of AI tools and understand how to use them but have no deeper knowledge of how AI tools produce their results and what inaccuracies or errors to look out for. The professor advocated for an educational approach that goes beyond mere tool proficiency, encouraging students to explore the theoretical foundations of AI, the ethical implications surrounding its implementation and its potential impact on the future of design. Increasing their general knowledge of AI and therefore developing an AI literacy should therefore be of high priority.

During a second interview with a design lecturer, the ethical reservations held by students regarding the use of AI-generated art were revealed. According to the professor, many students have concerns related to the origin and ownership of artworks produced through AI algorithms, as well as the potential for replication or infringement on existing artistic works. Students express a genuine interest in understanding the ethical implications of incorporating AI-generated elements into their projects. By creating a dialogue on ethical practices, students would be able to make informed decisions about incorporating AI into their creative processes while respecting the principles of artistic integrity and legal considerations.

3.3 Example Projects

As a third part of the methodology, a few example projects from the study courses were investigated. Some have already been created with AI or have a thematic focus on AI, while others show great potential for AI integration.

3.3.1 Museology

In the first project, 52 fabric pattern books were digitalised using two professional scanners. Metadata was allocated to the fabric data sets using the Adlib Information Systems software. An initial database has been completed and is now continuously optimised and extended (Haffner and Hornscheidt, 2015). Adlib allows for LIDO exports, the standard format required for online data portals like DBB[3], the German digital library with an array of cultural and sci-

[3]https://www.deutsche-digitale-bibliothek.de/?lang=en

entific resources, and Europeana[4], a European digital platform to access millions of cultural heritage items from museums, galleries, libraries and archives. Europeana has been instrumental in advancing the digitisation of cultural heritage across Europe (Macrì and Cristofaro, 2021).

Figure 1: Digitalisation of Fabric Books (Haffner and Hornscheidt, 2015).

The fabric pattern books themselves, as well as their digitised data, hold great potential for interdisciplinary projects that involve AI technology. An AI-driven image recognition algorithm could for example be used for pattern comparison across data sets and suggestions based on visual similarities. Fundamental knowledge in machine learning would allow students to classify the data and implement an AI-powered search functionality based on patterns, colours, material or keywords. Deng et al. (2023) used AI technology for fabric property analysis and proved AI's potential for pattern recognition and ethnic fashion design.

In the second project, the cultural heritage in public spaces in Berlin was digitalised, including sculptural monuments, fountains and fine arts. All elements are documented in a database accessible through a website, showcasing the location and further information about the cultural pieces. *Bildhauerei-in-Berlin* (BiB)[5] contains around 2,500 entries for a variety of cultural heritage. Students from museology heavily contributed to the data collection process for objects from the districts Köpenick and Lichtenberg.

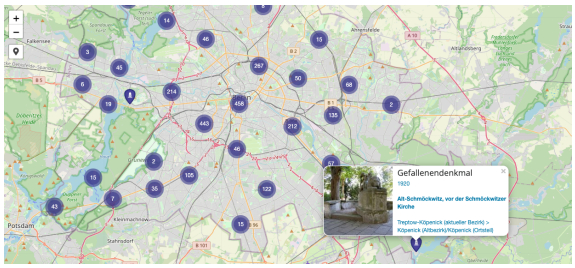

Figure 2: Map of Cultural Heritage in Berlin (Screenshot from https://bildhauerei-in-berlin.de/karte/).

The data entries contain various arrays of information and can be searched regarding epoch, material, category, technique, condition, completeness and location. A selection of five objects have been virtualised as 3D models.

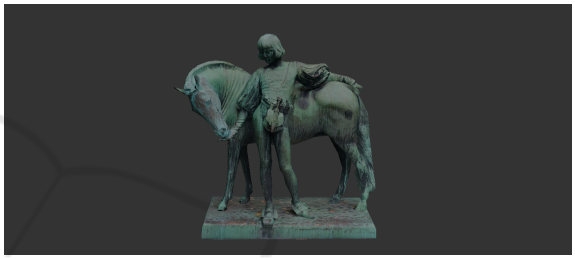

Figure 3: 3D Visualisation of Object (Screenshot from https://bildhauerei-in-berlin.de/bildwerk/knabe-mit-pony-6286/).

The BiB database could serve as a practical example for teaching AI concepts such as classification algorithms or basics of data analysis while also teaching the importance of data literacy and ethical data usage. Generative AI tools could also be tested for virtual reconstruction of missing or damaged parts.

3.3.2 Communication Design

During the Ars Electronica festival from 7th to 11th September 2022 in Linz, Austria, a variety of projects for art, technology and culture were exhibited. Students from the communication design study course presented seven of their projects on "Post-Intelligent Artificial Humanism"[6] at the exhibition. The projects focused on the impact of AI on humanity and the concept of "Planet B" while raising questions about interactions with a new form of intelligence and the consequences, both positive and negative, of integrating AI into our lives and society.

[4]https://www.europeana.eu/en
[5]https://bildhauerei-in-berlin.de/was-ist-bib/
[6]https://ars.electronica.art/planetb/de/artificial-humanism/

Figure 4: Project "Pattern" at Ars Electronica (Bürger et al., 2022).

One exemplary project was "Pattern" by Maria Bürger, Lea Gleisberg and Jana Staltmayer. The project utilises a neural network to interpret and recognise the meaning of doodles and is centred on a vast database comprised of globally contributed doodles. It further involves extracting scribbles from the database and employing a robotic drawing machine to overlay hundreds of them. The key question is whether the resultant image constitutes an anthropological study or an artwork (Bürger et al., 2022). Demir et al. (2021) took a similar approach and trained a neural network model to identify and categorise design principles in contemporary buildings. These projects showcased the interdisciplinarity of AI and design, specifically having an understanding of neural network functionality as well as handling extensive data sets and being aware of the data being utilised.

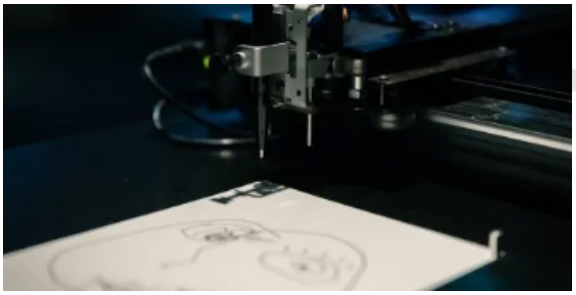

Figure 5: Project "Bot-I-Celli" at Ars Electronica (Ball et al., 2022).

Further, the work "Bot-I-Celli" by Änne Ball, Anna Brauwers and Anastasia Scherf explores the intersection of AI and creativity and questions whether AI can be considered creative. It delves into the future of art in a scenario where AI overtakes tasks traditionally performed by humans. The experience involves personalised portraits created by a robot, resembling caricatures drawn by street artists. The central focus point is the perceptual shift when the role of the artist transitions from a human to a robot (Ball et al., 2022). The project displayed the human-AI co-creative process and used algorithms for creativity. Students not only needed to understand how AI algorithms work but also develop their own to generate creative output.

4 AI COMPETENCIES

The following chapter defines specific competencies identified through the interviews and analyses and explains how these can be integrated. The three major fields of competencies that have been defined cover technology, ethics and application and can, therefore, be best assessed through the categories made by Laupichler et al. (2023): technical understanding, critical appraisal and practical application.

4.1 Technical Understanding

AI competencies for both cultural and design studies place a strong emphasis on fostering the technical understanding of machine learning, AI tool proficiency and data analysis. These skills are essential for navigating the complexities of AI applications. Technical competencies for both fields should therefore be:

- *AI Tool Proficiency*: Acquiring an in-depth understanding of AI tools
- *Machine Learning Fundamentals*: Knowledge of ML concepts for developing models to predict object labels and features
- *Data Analysis*: AI-driven analysis of databases regarding object features

For cultural studies, developing proficiency in data analysis is crucial for extracting meaningful information from data sets, as well as automating the process of formatting and cleaning data and recognising errors for effective database management. This includes extracting relevant information, ensuring data quality and preparing data sets for model training. The focus is not only on technical proficiency but also on the students developing a deeper understanding of machine learning functionalities, enabling them to use this technology for tasks like archival documentation, object classification and predictive analytics. The competencies specifically for cultural sciences could be:

- *Automated Data Entry*: Receiving suggestions for standardised formats
- *Automated Metadata Generation*: Automatically generate metadata for data entries
- *Error Recognition*: Ability to identify inaccuracies and errors in AI-produced results

- *Named Entity Recognition*: NLP integration to analyse and understand entities and keywords

Required AI competencies in design studies focus especially on general tool proficiency and a strong understanding of the underlying technology. This allows for informed decisions and critical assessment of AI-generated results. In that way, design students can use AI as a powerful tool to generate creative output and develop their own algorithmic tools, while also acquiring the knowledge to navigate potential risks (Holmquist, 2017). The suggested technical competencies for design are as follows:

- *Algorithmic Knowledge*: Understanding fundamental principles of AI tools to comprehend how algorithms generate results
- *Neural Network Understanding*: Knowledge of how neural networks operate, especially in the context of image interpretation and recognition
- *Algorithmic Creativity*: Writing AI algorithms for generating creative output

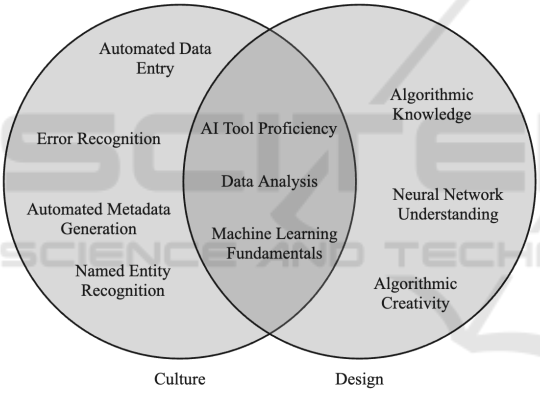

Figure 6: Technical Understanding Competencies for Culture and Design.

4.2 Critical Appraisal

Proficiency in critically evaluating and reflecting on AI usage is an essential part of AI literacy for cultural scientists and designers. This involves creating a deep understanding of the legal landscape surrounding AI-generated content, copyright regulations and ethical considerations related to the ownership and attribution of such works (Hayes, 2023). An emphasis is also on ensuring fair and unbiased data use in AI applications. In other words, developing a strong form of data literacy is important. It involves having an understanding of the data sources, their quality and potential biases that may influence AI outcomes. The following competencies are proposed for both fields:

- *Copyright Knowledge*: Familiarising with current laws on copyright of AI-generated content
- *Data Literacy*: Knowing what and by whom data is used for model training
- *Ethical Data Usage*: Use of fair and unbiased data for analyses

AI literacy for culture must contain skills to critically evaluate the legal and ethical implications of employing AI in cultural projects, especially for the handling and preservation of digitalised cultural objects (Groumpos, 2022). Further, AI can be used as a tool for curatorial research but its output should always be judged evaluatively. Potential competencies for the culture in this category are:

- *Curatorial Research*: Assistance in researching and developing exhibitions with AI tools
- *Digital Cultural Heritage Preservation*: Expertise in using AI for preservation with respect to authenticity, diversity and integrity of cultural artefacts
- *Ethical Handling of Digital Cultural Objects*: Responsible managing and interacting with cultural objects through AI

Using generative AI tools for creative design processes can support designers in creating more accessible and inclusive concepts and adhering to guidelines more easily. This involves an awareness of potential biases and the proactive inclusion of features that cater to diverse users. Utilising AI to evaluate design concepts from the perspective of end-users can ensure alignment with user needs, preferences and expectations, fostering a strong user-centred design process (Tholander and Jonsson, 2023). Additionally, acknowledging the environmental impact of AI is crucial for designers. It not only involves assessing the ecological footprint of used technologies but also considers factors such as energy consumption and resource usage, helping them to make informed decisions and contributing to more sustainable and responsible design practices (Van Wynsberghe, 2021). These competencies are advised for design studies:

- *Inclusive Design Considerations*: Consideration of inclusivity in AI-generated design
- *User-Centred Evaluation*: Assessment of design regarding usability
- *Environmental Impact of AI*: Acknowledging ecological consequences of AI technology

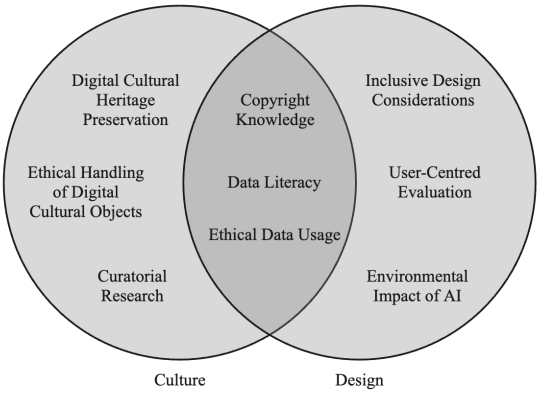

Figure 7: Critical Appraisal Competencies for Culture and Design.

4.3 Practical Application

Competencies for practically applying AI in cultural and design projects include proficiency in digitalisation tools which help both cultural scientists and designers transition from analogue to digital formats, preserving cultural artefacts and media. This also includes using NLP for transcription purposes to automatically convert spoken or written texts into digital documents, enhancing their accessibility. The co-creation between humans and AI supports both disciplines in developing a collaboration where human creativity utilises AI capabilities to produce innovative results (Wingström et al., 2023; Tholander and Jonsson, 2023). Both study fields could, therefore, benefit from these practical competencies:

- *Digitalisation Tool Proficiency*: AI-based digitalisation for analogue to digital formatting
- *Human-AI Co-Creation*: Creating synergies between humans and AI for artistic purposes
- *NLP Transcription*: NLP for automated digitalisation of spoken or written texts

Specifically, in cultural use cases, this could involve generative AI tools that are used for exhibition design (Oksanen et al., 2023), virtual reconstruction of cultural heritage objects (Moral-Andrés et al., 2023) or an analysis of visitor behaviour, including predictions of future visitor trends (Rani et al., 2023). With a wide skill set and in-depth knowledge of AI technologies, creative and innovative cultural projects can be conducted and the everyday work of cultural scientists supported. For cultural studies, the following competencies are put forward:

- *Exhibition Design*: Spatial analysis for layout and visitor flow optimisation
- *Virtual Reconstruction*: Use of generative AI for virtual reconstruction of missing or damaged cultural objects
- *Visitor Behaviour Analysis*: Understanding visitor movement in museums and other cultural institutions
- *Predictive Visitor Trends*: Forecasting visitor trends and anticipating peak visiting times for optimised staff management

Practically applying AI in design processes focuses especially on fostering creative collaboration between AI systems and designers. A range of AI tools can be used for design purposes including idea generation or content creation but also testing products for accessibility and inclusivity. AI can function as a versatile technology, offering insights, generating innovative concepts and streamlining repetitive tasks (Fatima, 2023; Caramiaux, 2020). In design, these practical competencies could be advantageous:

- *Accessibility and Inclusivity Testing*: Testing for accessibility and inclusivity with AI
- *Content Design*: Use of AI for creation of design elements
- *Idea Generation*: AI tools for supporting the creative process

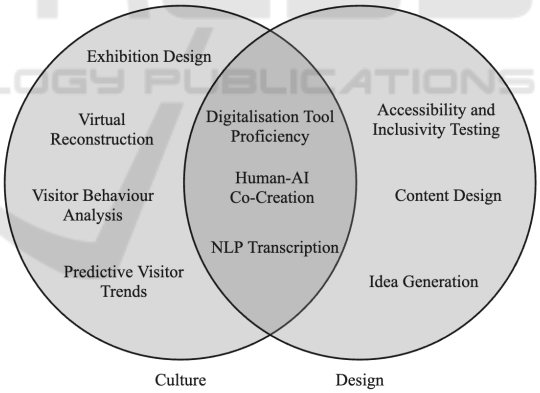

Figure 8: Practical Application Competencies for Culture and Design.

5 CONCLUSION

In this paper, we have applied the AI literacy framework by Laupichler et al. (2023) to culture and design studies. Two study programs in museology and communication design were used as examples. Through curricula analysis, expert interviews and project reviews we identified AI competencies important to those fields.

The competencies developed through museology studies, including inventory management, documentation, exhibition curation and visitor research, provide a solid foundation for integrating AI technologies into the curriculum. Communication design students can use AI to iterate collaboratively through design tasks, concepts and ideas.

Technical competencies focused in both disciplines on general tool proficiency, machine learning fundamentals and data analysis understanding. For cultural specialists, this means in particular increased efficiency when working with databases, while designers are supported in their creative process.

Critically reflecting on AI use is a key component of AI literacy and knowledge on copyright issues, fostering data literacy and usage of ethical and fair data are the main competencies in culture and design. For both studies specifically, this involves the sensitive and responsible handling of cultural objects and focusing on accessible and inclusive designs.

AI competencies can be practically applied in many use cases, however, a general digitalisation tool proficiency, the sense of human-AI co-creation and NLP transcription were found to be essential for both fields. In the cultural sector, practical AI use cases could include analysis and prediction of visitors or exhibition design and curation. AI in design, on the other hand, is applied for generating design ideas and concepts, as well as for producing content.

The concepts presented in this paper will provide a foundation for educational programs and curricula development. While this study was limited to two exemplary study programs, the methodology can also be used in future more extensive research at other universities as well as different disciplines.

ACKNOWLEDGEMENTS

This paper portrays the work carried out in the context of the KIWI project (16DHBKI071) that is generously funded by the Federal Ministry of Education and Research (BMBF).

REFERENCES

Abbasi, M., Vassilopoulou, P., and Stergioulas, L. (2017). Technology roadmap for the creative industries. *Creative Industries Journal*, 10(1):40–58.

Amato, G., Behrmann, M., Bimbot, F., Caramiaux, B., Falchi, F., Garcia, A., Geurts, J., Gibert, J., Gravier, G., Holken, H., et al. (2019). AI in the media and creative industries. *arXiv preprint arXiv:1905.04175*.

Ball, Ä., Brauwers, A., and Scherf, A. (2022). Bot-I-Celli. https://ars.electronica.art/planetb/de/bot-i-celli/. Online; accessed 22.02.2024.

Bordoni, L., Ardissono, L., Barceló, J. A., Chella, A., de Gemmis, M., Gena, C., Iaquinta, L., Lops, P., Mele, F., Musto, C., et al. (2013). The contribution of AI to enhance understanding of Cultural Heritage. *Intelligenza Artificiale*, 7(2):101–112.

Bürger, M., Gleisberg, L., and Staltmayer, J. (2022). Pattern. https://ars.electronica.art/planetb/de/pattern/. Online; accessed 22.02.2024.

Caramiaux, B. (2020). *Research for CULT committee-The use of artificial intelligence in the cultural and creative sectors*. PhD thesis, CULT Committee, European Parliament.

Caramiaux, B. (2023). *AI in Museums: Reflections, Perspectives and Applications*, volume 74, chapter AI with Museums and Cultural Heritage, pages 117–130. transcript Verlag.

Colavizza, G., Blanke, T., Jeurgens, C., and Noordegraaf, J. (2021). Archives and AI: An overview of current debates and future perspectives. *ACM Journal on Computing and Cultural Heritage (JOCCH)*, 15(1):1–15.

Demir, G., Çekmiş, A., Yeşilkaynak, V. B., and Unal, G. (2021). Detecting visual design principles in art and architecture through deep convolutional neural networks. *Automation in Construction*, 130:103826.

Deng, M., Liu, Y., and Chen, L. (2023). AI-driven innovation in ethnic clothing design: an intersection of machine learning and cultural heritage. *Electronic Research Archive*, 31(9):5793–5814.

D'Ignazio, C. (2017). Creative data literacy: Bridging the gap between the data-haves and data-have nots. *Information Design Journal*, 23(1):6–18.

Faruqe, F., Watkins, R., and Medsker, L. (2021). Competency model approach to AI literacy: Research-based path from initial framework to model. *arXiv preprint arXiv:2108.05809*.

Fatima, I. (2023). Designing with AI: A User Study to Explore the Future Role of AI as a Collaborative Tool in Graphics Design.

Fui-Hoon Nah, F., Zheng, R., Cai, J., Siau, K., and Chen, L. (2023). Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration.

Groumpos, P. P. (2022). Ethical AI and Global Cultural Coherence: Issues and Challenges. *IFAC-PapersOnLine*, 55(39):358–363.

Haffner, D. and Hornscheidt, K. (2015). *Stoffmuster im Fokus-Renaissance und Rezeption: Tagung in Berlin, 11. Oktober 2013; zu Ehren und anlässlich der Verabschiedung von Prof. Dr. Sibylle Einholz*. netzwerk mode textil eV.

Hayes, C. M. (2023). Generative Artificial Intelligence and Copyright: Both Sides of the Black Box. *Available at SSRN 4517799*.

Holmquist, L. E. (2017). Intelligence on tap: artificial intelligence as a new design material. *interactions*, 24(4):28–33.

Jo, S., Bae, G.-T., Song, H., Jung, S., Kang, Y., Shin, J. S., Choi, J., and Park, J.-w. (2022). Artificial Intelligence

Curation System for Museums. *TECHART: Journal of Arts and Imaging Science*, 9(3):6–10.

Kulesz, O. (2020). Supporting culture in the digital age. *Surry Hills, Australia: International federation of Arts Councils and Culture Agencies. https://ifacca. org/en/news/202 0/04/23/supporting-culture-digital-age/accessed April*, 25:2020.

Laato, S., Vilppu, H., Heimonen, J., Hakkala, A., Björne, J., Farooq, A., Salakoski, T., and Airola, A. (2020). Propagating AI Knowledge Across University Disciplines-The Design of A Multidisciplinary AI Study Module. In *2020 IEEE Frontiers in Education Conference (FIE)*, pages 1–9. IEEE.

Laupichler, M. C., Aster, A., Haverkamp, N., and 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.

Long, D. and Magerko, B. (2020). What is AI literacy? Competencies and design considerations. In *Proceedings of the 2020 CHI conference on human factors in computing systems*, pages 1–16.

Lowagie, H. (2023). From Bias to Transparency: Ethical Imperatives in AI-Based Library Cataloging.

Macrì, E. and Cristofaro, C. L. (2021). The digitalisation of cultural heritage for sustainable development: The impact of Europeana. *Cultural Initiatives for Sustainable Development: Management, Participation and Entrepreneurship in the Cultural and Creative Sector*, pages 373–400.

Marchello, G., Giovanelli, R., Fontana, E., Cannella, F., and Traviglia, A. (2023). CULTURAL HERITAGE DIGITAL PRESERVATION THROUGH AI-DRIVEN ROBOTICS. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 48:995–1000.

Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., and Galstyan, A. (2021). A survey on bias and fairness in machine learning. *ACM computing surveys (CSUR)*, 54(6):1–35.

Moral-Andrés, F., Merino-Gómez, E., Reviriego, P., and Lombardi, F. (2023). Can artificial intelligence reconstruct ancient mosaics? *Studies in Conservation*, pages 1–14.

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., and Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2:100041.

Ntoutsi, E., Fafalios, P., Gadiraju, U., Iosifidis, V., Nejdl, W., Vidal, M.-E., Ruggieri, S., Turini, F., Papadopoulos, S., Krasanakis, E., et al. (2020). Bias in data-driven artificial intelligence systems—An introductory survey. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, 10(3):e1356.

Oksanen, A., Cvetkovic, A., Akin, N., Latikka, R., Bergdahl, J., Chen, Y., and Savela, N. (2023). Artificial intelligence in fine arts: A systematic review of empirical research. *Computers in Human Behavior: Artificial Humans*, page 100004.

Pansoni, S., Tiribelli, S., Paolanti, M., Di Stefano, F., Malinverni, E., Frontoni, E., Giovanola, B., et al. (2023). Artificial Intelligence and Cultural Heritage: Design and Assessment of an Ethical Framework. In *29th CIPA Symposium "Documenting, Understanding, Preserving Cultural Heritage. Humanities and Digital Technologies for Shaping the Future"*, volume 48, pages 1149–1155. The International Archives of the Photogrammetry, Remote Sensing and Spatial ....

Pavlidis, G. (2022). AI trends in digital humanities research. *Trends Comput Sci Inf Technol*, 7(2):026–034.

Piotrowski, M. (2012). *Natural language processing for historical texts*. Morgan & Claypool Publishers.

Raina, V., Krishnamurthy, S., Raina, V., and Krishnamurthy, S. (2022). Natural language processing. *Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice*, pages 63–73.

Rani, S., Jining, D., Shah, D., Xaba, S., and Singh, P. R. (2023). Exploring the Potential of Artificial Intelligence and Computing Technologies in Art Museums. In *ITM Web of Conferences*, volume 53. EDP Sciences.

Sangüesa, R. and Guersenzvaig, A. (2019). AI as a Design Material: Dealing with new agencies. *Temes de Disseny*, (35):6–25.

Schumann, C.-A., Reuther, K., Tittmann, C., Clauß, A.-M., and Kauper, J. (2020). Impact of ai application on digital education focused on ste (a) m. In *EDEN Conference Proceedings*, number 1, pages 153–161.

Sporleder, C. (2010). Natural language processing for cultural heritage domains. *Language and Linguistics Compass*, 4(9):750–768.

Terras, M., Coleman, S., Drost, S., Elsden, C., Helgason, I., Lechelt, S., Osborne, N., Panneels, I., Pegado, B., Schafer, B., et al. (2021). The value of mass-digitised cultural heritage content in creative contexts. *Big Data & Society*, 8(1):20539517211006165.

Tholander, J. and Jonsson, M. (2023). Design ideation with ai-sketching, thinking and talking with Generative Machine Learning Models. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference*, pages 1930–1940.

Van Wynsberghe, A. (2021). Sustainable AI: AI for sustainability and the sustainability of AI. *AI and Ethics*, 1(3):213–218.

Verheijden, M. P. and Funk, M. (2023). Collaborative Diffusion: Boosting Designerly Co-Creation with Generative AI. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems*, pages 1–8.

Wang, B., Rau, P.-L. P., and Yuan, T. (2023). Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale. *Behaviour & information technology*, 42(9):1324–1337.

Wang, Q. and Li, L. (2022). Museum Relic Image Detection and Recognition Based on Deep Learning. *Computational Intelligence and Neuroscience*, 2022:1–11.

Williams, R. (2023). A review of assessments in k-12 ai literacy curricula.

Wingström, R., Hautala, J., and Lundman, R. (2023). Redefining creativity in the era of AI? Perspectives of computer scientists and new media artists. *Creativity Research Journal*, pages 1–17.

Zhao, M., Wu, X., Liao, H.-T., and Liu, Y. (2020). Exploring research fronts and topics of Big Data and Artificial Intelligence application for cultural heritage and museum research. In *IOP Conference Series: Materials Science and Engineering*, volume 806, page 012036. IOP Publishing.

Zylinska, J. (2023). Art in the age of artificial intelligence. *Science*, 381(6654):139–140.