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The Quest for Ethical AI in Higher Education

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Abstract

The upcoming AI Act from the European Union (European Parliament, 2023) and the ethical issues that have been occurring with Artificial Intelligence (AI) constitute an urgent need for good governance. Especially within the education sector, where AI can cause harm to the values of vulnerable people. This thesis will answer the research question how are organisations in tertiary education sections developing good governance for AI? Firstly, it is identified how AI is being used in educational software. Then it is analysed how the educational software contains and harms values and what ethical issues might occur. To identify what governance practices are already available for higher education institutions to avoid ethical issues, three guidelines are analysed on their applicability and ability to help institutions create governance for AI in educational software: the AI and Education Guidance for Policymakers (Miao et al., 2021), the Ethical Guidelines on the Use of Artificial Intelligence and Data in Teaching and Learning for Educators (European Commission, Directorate-General for Education, Youth, Sport, and Culture 2022), and the Ethical framework for AI in Education (The Institute for Ethical AI in Education, 2020). However, as this research shows, these guidelines do not offer enough guidance to create good governance for AI in educational software. Therefore, this thesis identifies possible good governance practices to bridge the gap between policy and practice-driven applications.

Keywords: Articifial Intelligence, AI Ethics, AI Governance, AI in Education

Contents

1 Introduction

In the last few years, several ethical frameworks and guidelines for implementing responsible Artificial Intelligence (AI) have been published (Algorithmwatch, 2020). For example, the European Commission's high-level expert group (HLEG) has published a report on ethical AI practices in Education (2019). UNESCO has published an AI ethics guideline for policymakers (Miao et al., 2021) and many other organisations, researchers and commercial companies are publishing their guidelines (AlgorithmWatch, 2020). This shows that there is a lively discourse on the necessity of AI ethics and governance. The need for AI ethics and governance can be detected in three distinct domains: academia, policymakers and societal actors, and AI developers.

Firstly, academics are participating in the discourse on AI ethics. Philosophy departments, critical data and AI studies, and parts of computer science are discussing the need for AI ethics and looking for applicable solutions. The academic field has contributed to the publication of AI ethics guidelines by also publishing guidelines themselves. For example, Aiken and Epstein (2000) already debated in 2000 on AI ethics guidelines. Another example, Floridi et al. (2018) published AI4People, a guideline that proposes five ethical principles that should undergird its development and adoption: Beneficence, non-maleficence, autonomy, justice, and explicability. Beneficence entails promoting well-being, preserving dignity, and sustaining the planet. Non-maleficence entails not harming for example, privacy, and security. Autonomy entails the power to decide. Justice entails promoting prosperity and preserving solidarity. Lastly, explicability entails enabling other principles through intelligibility and accountability (Floridi et al., 2018). To help implement these principles, they give twenty recommendations that will help minimise risks and respect the principles. Another example is the AI ethics maturity model by Krijger et al. (2022). This model can be used to see how mature an organisation is with AI in six different dimensions: awareness & culture, policy, governance, communication & training, development processes, and tooling.

Besides contributing to AI ethics guidelines, the academic field has also been discussing issues of AI ethics guidelines. For example, the IEEE AI ethics group started an initiative to provide guidelines to prioritize human well-being in the forthcoming evolutions of artificial intelligence and autonomous systems (Shahriari & Shahriari, 2017). To add to this initiative, Munn (2022) mentions in their paper that there is a large gap between principles and practice that is difficult to bridge. In addition to this, Krijger et al. (2022) remark that there is still a need for research that facilitates the move from the "what" of AI ethics to the "how" of governance and operationalisation in organisations. This problem between practice and principle, shows the lack of consensus on what ethical AI is and what requirements are necessary to achieve ethical AI. Franzke (2022) shows that most of the AI ethics guidelines use the term ethics without defining it. This causes the guidelines to start from a vague entry point since there is no explicit definition of what the authors understand as ethics. It is difficult to explain the potentially harmful consequences of using software with AI technologies without the reader being informed about the author's point of view (Franzke, 2022). Besides the lack of explanation of AI ethics, the AI ethics guidelines also lack consensus on what principles should be requirements and what those principles entail. Jobin et al. (2019) show the debate on the most common principles of AI ethics among these guidelines and how they vary in their explanation of them. Their study shows the difference in the understanding of these principles and how each guideline interprets them differently. This is also what Mittelstadt (2019) argues in their paper, the values and principles proposed are often generic and

abstract and do not provide sufficient guidance in practice. In addition to the humanities, computer science researchers are also investigating the responsible application of AI. For example, Margaret Mitchell and Timnit Gebru with other scholars Vinodkumar Prabhakaran and Iason Gabriel, published A Human Rights-Based Approach to Responsible AI. In their research, they show that AI-based interventions lack an explicit alignment with a set of normative values and principles. They argue that a human rights framework orients the research in this space away from the machines and the risks of their biases towards humans and the risks to their rights (Prabhakaran, V., Mitchell, M., Gebru, T., & Gabriel, I., 2022).

This thesis is also situated in a normative framework: the code of academic integrity of the Dutch Universities (KNAW, NFU, NOW, TO2-federatie, Vereniging Hogescholen & VSNU, 2018), and the values and ethics as expressed by Utrecht University(n.d.). It shares generally the ethics of open education and open science. It supports the autonomy, collegiality, and independence of students and shares the perspective that the student is central to the programme. My perspective as a student in the AI programme at Utrecht University is affecting the empirical research and analysis. It adds a layer of personal experience in both being a student and an expert in AI to the interpretation of findings as well as to my activities in the internship which provided empirical insights. These values tend towards virtue ethics, which entails that a person acts under virtue. Meaning they will do well and be content (Hursthouse and Pettigrove, 2023).

The second domain that participates in the discourse on the need for AI ethics is the societal or policy-making domain. Different policymakers, NGOs, and other public organisations call for the regulation of AI ethics. This need for regulation is shown in the publications of AI ethics guidelines, recommended practices, and other frameworks (AlgorithmWatch, 2020). These publications press on the pervasiveness of AI in everyday life and the risks and challenges that involve AI's social and ethical implications (Miao et al., 2021). For example, UNESCO (Miao et al., 2021), the European Commission, Directorate-General for Education, Youth, Sport, and Culture (2022), IEEE (Huang et al., 2023), the AI Now Institute (2019), and many others have published AI ethics guidelines (AlgorithmWatch, 2020). An example that shows the need for AI ethics, is the report by the Rotterdam Audit Office [de Rekenkamer] 'coloured technology' [Gekleurde technologie] (2021). They executed a critical review of data practices within the municipality of Rotterdam, focussing on how they use predictive algorithms and how they control the ethical risks of these algorithms. They introduced an algorithm register that registers information on every algorithm that is used by the municipality to get an insight into what exactly is used and to secure the ethics and quality of the algorithms. A theme in the publications and guidelines of policymakers on AI ethics is the protection of fundamental human rights. For example, HLEG (2019) published the ethics guideline for trustworthy AI, in which they issue a principled approach to make AI more trustworthy to protect fundamental human rights.

The last domain that is partaking in the discourse on the need for AI ethics is the corporations that develop AI and their developers. Big tech companies all have ethics teams that help contribute to the discourse of AI ethics. Google's AI ethics team published pioneering papers on AI ethics (Prabhakaran, V., Mitchell, M., Gebru, T., & Gabriel, I., 2022; Bender et al., 2021; Buolamwini, J., & Gebru, T., 2018). However, there have been controversies regarding these AI ethics teams. For example, Google fired its AI ethics team after they reported on the dangers of large language models (Schiffer, 2021). In addition to Google, Microsoft also laid off their AI ethics and society team (Schiffer & Newton, 2023). Besides these contributions, corporations also contribute

to AI ethics by publishing AI ethics guidelines. For instance, Microsoft published a Responsible AI standard, containing general requirements for implementing AI (2022). Google also proposes its own responsible AI practices to ensure the best way to build fairness, interpretability, privacy, and safety (Walker, 2023). BigScience Bloom created a responsible AI license to empower developers to place restrictions on the use of their AI technology through end-user and source code license agreements (BLOOM, n.d.). This shows that big tech companies themselves are also becoming more aware of the necessity of AI ethics. However, these examples also show their attempt at self-regulation regarding responsible AI to avoid regulation (Bietti, 2020). As Wagner (2018) states much of the debate about AI ethics seems to promise an easy alternative to government regulation to keep being able to innovate. Besides that, developers of AI systems themselves also warn of the harmful consequences of AI and press the need for AI ethics. For example, Raji et al. (2020) argue that during widespread AI deployment, comes valid concern about the effectiveness of these automated systems for the full scope of users, and especially a critique of systems that have the propensity to replicate, reinforce or amplify harmful existing social biases. They presented an internal algorithmic audit as a mechanism to check that the engineering process involved in AI system creation and deployment meets ethical expectations and standards.

The need for AI ethics and governance is increasingly relevant. The Scientific Council for Government Policy [Wetenschappelijke Raak voor het Regeringsbeleid] (2021) compared AI to a system technology, meaning that AI will be a technology that will affect every part of a system in society, just like a steam engine or a car. Because of this growing interest in the application of AI within many industries, there is an increased need to make AI more trustworthy and call for applied ethics to limit the disruptive potentials of new AI technologies (Hagendorff, 2019). Besides that, problems caused by AI systems have also been getting recognition which helps contribute to the increasing attention and need for AI ethics. For example, the problems with bias in AI systems such as the child benefits scandal [Toeslagenaffaire], where the Dutch government used algorithms and big Data to calculate risks that led to discrimination and privacy breaches (Amnesty International, 2023). Another example is the issues with privacy and AI such as with online proctoring during exams in COVID times (de Rechtspraak, 2021). Besides that, the European Union announced their work on the AI Act, the first regulation on artificial intelligence (European Parliament, 2023). As a result, developers and providers of AI software and systems are obliged to follow and implement these rules in their products. To anticipate the upcoming legislation, AI ethics can guide the implementation of these rules. This, in addition to the problems with AI and the increased application of AI, causes the need for AI ethics, identified in the discourse between the three domains mentioned above: academics, policymakers, and developers.

Besides that, during the writing of this thesis, there is a speedy transition to more AI-driven applications, making the governance questions more and more urgent. Generative AI applications and Artificial General Intelligence (AGI) are becoming increasingly mature and implemented in organisations and everyday use—for example, GITautopilots, ChatGPT, Microsoft Copilot, Google Gemini, etc. The definitions and the statements to follow in this thesis are a current overview of the situation but may rapidly change because of this speedy transition (Sahai, 2023). Artificial general intelligence (AGI) is not a topic this thesis will discuss further but it does have big effects on the education sector, for example in knowledge production or course design (Thorpe, 2023). These effects of AGI only make the governance questions more urgent.

The increasing use of AI in software, the issues that are arising with the use of

AI, and the upcoming AI legislation, cause organisations to try to create governance for AI in software. SURF, the organisation that facilitates IT infrastructure for the tertiary education sector in the Netherlands, is also dealing with this issue. SURF provides educational software that increasingly contains more AI technologies. Therefore, SURF wants to help institutions better govern the applications that use AI technologies. SURF is a co-operation, meaning that it is focused on public values and is anticipating the need of its members to provide more ethical AI in the software that it provides. In addition, they must also comply with the AI Act in the near future.

SURF is an association with a business, meaning that its members pay for their services. SURF is owned by its members and together decide on the direction of SURF. SURF serves five sectors within education and research in the Netherlands: MBOs, HBOs, universities, UMCs and research institutions. Over one hundred institutions are members of the SURF cooperative. An institution can become a member when the core activity of the institution is education or research, or if they make a substantial contribution to it (SURF, n.d., g). SURF has three roles: service provider, association, and innovator (SURF, 2020). In these roles, SURF is exploring how they must govern the AI technologies that are being implemented in the services that they provide to educational institutions. Since the legislation for these AI systems is still being developed by the EU. This is where they are experiencing difficulties in trying to implement, use, provide, and help their institutions with responsible AI systems.

To improve this, SURF wants to know how they can approach creating good governance for AI in educational software and how they can help their members create good governance for AI in educational software. However, to approach this, research must be done. SURF does not have an overview of what services currently use AI technologies or how AI is being implemented in educational software. In addition, SURF is looking for the best approach to create governance instruments. Therefore, the following research question will be answered in this thesis: **How are organisations in the tertiary education sector developing good governance for AI?**

The first chapter will inquire about where AI can be found in educational software. This chapter provides an inventory of how AI is being used in higher education software, as of November 2023. This is done by giving a brief oversight of what AI is and what technologies it uses. This is necessary to investigate and recognize the AI services that SURF offers to its members and what other educational software applications use AI technologies.

The second chapter will further analyse the educational software applications from the first chapter. It will assess what ethical issues can occur when using AI applications. This is done by examining three different educational applications to see how AI within educational software could harm values. This will help show why the governance of AI in educational software is needed.

The third chapter will revisit practices of good governance for AI in educational software that are available to help prevent the ethical issues presented in the previous chapter. This will be done by inquiring what governance practices are available to create good governance for AI in educational software. It will be assessed what ethical frameworks are available to implement to help create good governance for AI in educational software. In addition, the chapter will also assess how organisations such as SURF are reacting to the challenges of AI in educational software and what governance instruments they provide.

The last chapter will elaborate on what instruments can be applied to help create

good governance for AI in software for higher education. Drawing from experience at such an institution, this thesis develops several suggestions for implementing governance practices. This will help show what good governance is and show how organisations such as SURF can improve their attempt to govern AI in higher education.

2 AI in educational software

Artificial Intelligence has quietly entered the classroom (Holmes et al.,2019; European Commission,, Directorate-General for Education, Youth, Sport, and Culture, 2022; Miao et al., 2021). Adaptive, or personalized learning systems are increasingly being deployed in schools and universities around the world, gathering and analysing vast amounts of student data, and significantly impacting the lives of students and educators (Holmes et al., 2019). Wadhani (2023) shows that the expected market for intelligent, adaptive, and personalised learning systems for deployment in schools and universities by the private sector is estimated to be worth US$6 billion in 2024. Besides that, the COVID-19 pandemic pushed educational institutions towards digital alternatives (e.g. Miao et al., 2021).

To get insight into how AI is being deployed in higher education, this chapter will answer the research question, 'Where can AI be found in educational software?' This question will be answered by first looking at the definition of AI and commonly used AI technologies. This will then be used to create an inventory of AI applications that are available for higher education. Firstly, the services that SURF provides to the tertiary education sector in the Netherlands will be examined to add to the inventory. Then, other AI applications will be added to the inventory.

2.1 What is AI?

To see how AI is being used in educational software, it is important to first understand what AI is and what AI technologies there are. Therefore, this section will look at the discussion on the definition of AI and commonly used AI technologies. This can then be used to recognize how AI is being used in educational software in the following section of this chapter.

There is no one definition of *Artificial Intelligence*. Since the term Artificial Intelligence was first used in the Dartmouth workshop (Russel et al., 2010; Frankish & Ramsey, 2014), there has been an ongoing discussion on what exactly the definition of Artificial Intelligence is.[1] The HLEG (2019) published a definition of artificial intelligence "AI refers to systems that display intelligent behaviour by analysing their environment and taking actions, with some degree of autonomy, to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world, or AI can be embedded in hardware devices." While Rich and Knight (1992) define AI as the study of how to make computers do things at which, at the moment, people are better.

It is important to note that AI is not built in a vacuum but is being implemented in a society with the realities of discrimination and unfair practices. This will have consequences on the development process and the implementation and usage of AI systems (Schwartz et al., 2022). It helps thereby to understand AI as a socio-technical system that acknowledges that the processes used to develop technology are more than mathematical and computational constructs as shown in the definitions above (Schwartz et al., 2022). Next to the socio-technical context and technical definitions, to see how AI is being used in these software applications, AI technologies will be discussed. AI systems can use different technologies to operate, learn, and interact with the environment (Soori et al., 2023).

[1] Marvin Minsky defined AI as the science of making machines do things that would require intelligence if done by men (Dennis, 2001). While Russel and Norvig (2010) try to define AI by stating four different approaches that AI should contain: thinking humanly, thinking rationally, acting humanly, and acting rationally. John McCarthy, one of the first AI researchers, defined AI as "the science and engineering of making intelligent machines" (Manning, 2022).

Today, many AI systems rely on machine learning algorithms to work (Mahesh, 2020). Mitchell (1997) defines machine learning algorithms as A computer program that is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E. There are three different approaches to machine learning. Firstly, supervised machine learning algorithms are trained on data that has been labelled (Mahesh, 2020). The algorithm learns to link new data to already existing labels that are used in the data on which the algorithm was trained (Russel et al., 2010). Secondly, unsupervised machine learning algorithms are trained on data that has not been labelled (Mahesh, 2020). Therefore, the unsupervised algorithms aim to uncover hidden patterns in the training data and classify new data in these patterns (Russel et al., 2010). Thirdly, reinforcement learning algorithms learn through continuous feedback. With the training data, the algorithm creates a model which is assessed as correct or incorrect. After this, the algorithm is punished or rewarded for its result. This punishment or reward is then used by the algorithm to update the model (Russel et al., 2010).

Recently, Large Language Models (LLMs) have gained more interest since the launch of ChatGPT in November 2022 (Teubner et al., 2023). LLMs are a part of natural language processing. They are models trained on massive amounts of text data and can generate human-like text, answer questions, and complete other language-related tasks with high accuracy (Kasneci et al., 2023).

Now that the definition of AI and common AI technologies have been discussed, it can be assessed how AI is being used in educational software. This will be firstly done by examining how AI is being used in the services that SURF offers to its members. In the section after that, it will be assessed how AI is being used in educational software that SURF does not necessarily provide for its members. To show how AI tools can be used in higher education.

2.2 AI in SURF's services

The previous section described what AI is and what the commonly used AI technologies are, this section will answer the research question, 'What services does SURF offer to its members that use AI technologies?' This will help show how AI is being used in the software that is provided for higher education institutions.

As a service provider, SURF offers many services to its member institutions (SURF, n.d., b). This ranges from network connectivity to compute services. But also, digital platforms and cyber security. The services focus on enabling and providing the IT infrastructure for higher education. Some services provide the platform or space to create AI applications. For example, SURF can provide computing time on their supercomputer, funded by the NWO, to train computer calculation models, which can be used to train machine learning models (SURF, n.d., f). Another example is the high-performance machine learning team of SURF that programmes machine learning models for researchers on request.

Aside from the services that SURF develops itself, SURF also procures contracts as a service for its members. SURF bundles the need for software applications and takes the middleman role between institutions and software providers. This causes SURF to handle all the contracts instead of the institutions themselves. The software contracts that can be procured through SURF range from exam software to graphic design licenses, to administrative software. An overview of the software suppliers can be found on SURF's website, which is incomplete for legal reasons (SURF, n.d., a). At least twenty-two of

these software providers use AI technologies in their software (Appendix B). For example, the largest software provider that can be procured through SURF is Microsoft. Microsoft uses AI for example in Microsoft Word to guess the most likely next word or in the calendar application to suggest the most optimal moment for a meeting (Spataro, 2023). Besides Microsoft, software providers that develop proctoring software, plagiarism control software, machine translators, digital learning tools, and grading assistance software are also available to procure via SURF (Appendix B). Table 1 shows examples of software applications that can be procured through SURF.

Software	**Application**	**Category**
FeedbackFruits	Feedback application where students can give each other feedback and the system also provides feedback generated by AI.	Student Supporting
Proctorio	Proctoring software that tracks students' behaviour during exams through a webcam. AI is used to monitor and flag suspicious behaviour.	Teacher Supporting
Euroglot	An offline translator that helps automatically translate texts with neural networks.	Student Supporting

Table 1: Example for three out of twenty-two applications of AI software that can be procured through SURF, the complete list can be found in Appendix B.

The software applications use AI in various manners. For example, *Proctorio* (Table 1) is a proctoring software application. These systems oversee students sitting online exams by using AI (Coghlan et al., 2021). During an exam, a student and their surroundings are monitored through a webcam. In this case, AI is used to monitor the student and assess whether the behaviour of the student during the exam is suspicious. Another example is *FeedbackFruits* (Table 1). This is a learning management system tool that helps provide assessment and feedback tools, social annotation tools, and engagement and interaction tools. FeedbackFruits uses AI technology to receive automatic feedback on their academic writing skills. The tool addresses citations, academic style, grammar, and structure. FeedbackFruits uses AI technologies within their automatic feedback function to recognize spelling and grammar mistakes and general feedback about sentence structure. Lastly, an example is *Euroglot* (Table 1), which is an offline translator that automatically translates texts with their neural network model. This is done offline to protect sensitive documents from being spread. In this application, artificial neural networks are used to translate text from one language to another language.

The three examples of Proctorio, FeedbackFruits, and Euroglot (Table 1), show various ways of how AI can be used in software for higher education. SURF has not developed AI applications themselves but does offer software licenses or contract procurement with other developers that use AI in their software, such as proctoring software, plagiarism control, feedback software, and data science tools (Appendix B).

2.3 AI in educational software applications

As discussed in the previous section, AI software can be procured through SURF, but SURF does not offer any AI software applications they have developed themselves. However, internal stakeholder surveys indicate an interest of the SURF members in AI-containing software applications (SURF, 2021). SURF (2022, a) published a discussion

paper on the promises of AI in higher education to explore how AI is currently used in higher education. For this paper, they created an inventory of AI-containing applications used in higher education. Drawing from this inventory it will be further explored how AI is being used in software for higher education by extending this inventory. In total sixty-six applications were added and analysed. The first thirty applications were already added by SURF (2022, a). The other thirty-six applications were found with reference to search as a research method in a context-informed Google Search using queries such as [edtech companies], [AI education], [AI systems education], and [examples AI in education] (Rogers, 2013, p.95) (Appendix A).

Each application was added to a table (Appendix A) where information was registered on the functions of the application, how it works, a link to the website of the application for more information, if the application was made from a commercial or non-profit provider and in what country it was developed. All the applications were categorized into user categories and goal categories. The categories from the ethical guidelines on the use of Artificial Intelligence and Data in teaching and learning for educators (European Commission, Directorate-General for Education, Youth, Sport, and Culture, 2022) were used here to categorize the AI applications. These categories show that AI systems can be used in diverse ways to support teaching and facilitate learning. The types of AI systems that are used for teaching, learning, assessment, and school administration are then divided into four distinct categories with each category being divided into sub-categories (European Commission, Directorate-General for Education, Youth, Sport, and Culture, 2022). Firstly, Student Teaching for using AI to teach students. Secondly, Student Supporting for using AI to support student learning. Thirdly, Teacher Supporting for using AI to support the teacher. Lastly, System Supporting for using AI to supporting diagnostic or system-wide planning. Not all software applications might use AI technologies for the main function of the application. For example, Microsoft Word uses AI to predict upcoming words, but this does not impact the primary functionality of the software, which in this case is a writing tool and can therefore be categorized within the Student Supporting category. Table 2 portrays a subset of the entire table of AI applications for higher education (Appendix A).

What resulted from the inventory was that more than half of the AI applications are developed for the student categories, with almost an even split for the Student Teaching and Student Supporting applications, with 38.5% and 35.4% respectively. Showing that the focus of educational software with AI technologies for education is mostly on students. Most of the Student Teaching software are Intelligent Tutoring Systems. Intelligent Tutoring Systems create a personalised learning path for students and adapt it to the needs of the students (Graesser, 2012). For example, *PhotoMath* (Table 2) is an application that uses a camera to scan and recognize mathematical equations. The app then displays step-by-step explanations for the equation and solution. The application uses image recognition to detect the equation to then show the solution and explanation. Most of the Student Supporting applications are Formative Writing Assessments. Formative Writing Assessments help students write essays, give automatic feedback on their text, and help them see where they can improve (European Commission, Directorate-General for Education, Youth, Sport, and Culture, 2022). For example, *OpenEssayist* (Table 1), is an application that provides feedback to students when preparing for an essay. It processes the text of the essay and a web application for linguistic analysis and produces feedback the student can use to improve their essay.

The software applications that were developed for the category Teacher Support are 21.5% of the educational applications. Such as *Edaptio* (Table 2), which is a digital

Software	Application	Category
OpenEssayist: an automated feedback tool	Open University UK created OpenEssayist to provide feedback to students when preparing for an essay. It is a real-time analytics tool which operates through the combination of a linguistic analysis engine that processes the text in the essay, and a web application that uses the output of the linguistic analysis engine to generate the feedback.	Student Supporting
Examus	Examus is an AI proctoring solution that determines whether a student is cheating on an exam.	Teaching Supporting
Edaptio	Edaptio is a digital classroom helper for teachers. It helps create and deliver interactive presentations, assessments, and content, and track students' progress – an all-in-one platform.	Teacher Supporting
Photomath	Photomath is an application that analyses a picture of a mathematical equation and provides the solution and explanation.	Student Teaching
Ivy Chatbot	Ivy is a chatbot that assists in the processes of the university such as application forms, enrolments, tuition, and deadlines.	System Supporting

Table 2: Educational Software examples of AI applications in education, the entire list of 66 applications can be found in Appendix A.

classroom helper for teachers. It helps create and deliver interactive presentations, assessments, and content, and track student progress. This application uses AI to suggest adjustments to the teacher based on the student's progress. Lastly, around 5% of the applications were developed within the category of System Supporting, such as *Ivy Chatbot* (Table 2), which is a chatbot that assists in the processes of the university such as application forms, enrolments, tuition, and deadlines. The chatbot is trained on millions of questions asked by users and with that can select the right answer to each question.

The providers of the AI applications were also taken into consideration when creating the inventory. Two-thirds of applications were provided by commercial companies and were paid applications, while one-third of the applications were provided with open-source software and were openly accessible (Appendix A). In conclusion, many AI applications are already being deployed in higher education. Most of these applications are specifically developed for students, to support them in their learning and student life or to specifically teach them. From Appendix A and Table 2, it can be concluded that AI is used in various manners in higher education in the different software applications.

2.4 Conclusion

This chapter aimed to answer the research question, how is AI used in the software that is used in higher education? To answer the question, first, the definitions and technologies of AI were explained. To see how AI is being used in higher education software, this chapter examined the services that SURF provides to higher educational institutions that use AI technologies. SURF does the procurement for institutions with software providers for higher education that use AI technologies. These are mainly proctoring software, plagiarism control software, feedback software, and data science tools. Drawing from an inventory SURF created (2022) additional AI applications were added to further examine how AI is being used in higher education. From this inventory, it can be concluded that the AI applications that are used in higher education mainly are made for students to educate them or support them in their learning.

This chapter has shown that there are many AI applications already being used in higher education. These applications contain values and are also used in an environment that has its own norms and values. The question remains what the consequences are for the sector and the students using these applications? Besides that, how is the addition of AI technologies to these software applications changing the values of these applications and perhaps harming the values of the environment in which they are being used? To answer these questions, the next chapter will investigate the AI applications mentioned in this chapter and examine potential ethical issues that can arise with the use of these applications.

3 The ethical issues of AI in educational software applications

The previous chapter investigated how AI is being used in software for higher education. It was shown that there is a variety of how AI is being used in these applications. This chapter will look into how the addition of AI in these applications is changing the values of the applications and the environment they are being used in, by answering the research question, 'What are the ethical issues of AI in educational software applications?'. To answer this question, this chapter will investigate three different examples of educational software that are mentioned in the previous chapter and inquire what ethical issues could arise with these examples.

The use of AI in educational software applications can cause potential ethical issues. As discussed in the introduction there have been issues and scandals regarding the use of AI, such as the child benefits scandal [Toeslagenaffaire] (Amnesty International, 2023), the use of deepfakes to manipulate and undermine trust (Byman et al., 2023), the use of AI applications in Chinese education to monitor students attention (Liu, 2020), or the manipulation through targeted information such as with the Facebook – Cambridge Analytica data scandal (Confessore, 2018). Besides the scandals, issues arise with the lack of explainability when using AI technologies, i.e. not being able to understand how the application is deciding on what conclusion (HLEG, 2019). All these issues and scandals harm ethical values (Jørgensen & Bozeman, 2007). As already mentioned, it is important to think of AI as a socio-technical system that acknowledges that the processes used to develop technology are more than mathematical and computational constructs as shown in the definitions above (Schwartz et al., 2022).

When AI is used in education, other values might be harmed as well as the values mentioned above (Holmes et al., 2022). Education concerns and reaches different audiences, pressing the issue of other values being harmed. For example, education reaches vulnerable people, such as young people, people from all layers of society, and those from lower socio-economic backgrounds. In addition to this, there often is a power imbalance between teachers and students. This all makes the users of AI applications in education less prepared and less aware of what they are using and how it might affect them. Holmes et al. (2021) mention in their book that AI in education research needs to explicitly address issues such as the purpose of the learning, the choice of pedagogy, the role of the technology concerning teachers (to replace or augment human functions), and access to education. To see what ethical values might be harmed, this thesis created an inventory of potential ethical issues with the use of the applications in the previous chapter (Appendix A; Appendix D). A short overview of Appendix D can be found in Table 3, which is the basis for the following three paragraphs that exemplify the issues of AI in education.

Proctorio is an online proctoring system (OPS) (Table 3) that provides a way to continue examination when physical examination on campus is not possible (Coghlan et al., 2021). With the use of Proctorio, the student is monitored and recorded to detect any suspicious behaviour and to protect academic integrity. To determine suspicious behaviour, the student and their surroundings are monitored through a webcam. There are ethical issues that can occur with the use of Proctorio. Firstly, Proctorio can lead to privacy issues (Table 3; Coghlan et al., 2021; Draaijer et al., 2018; Swauger, 2020). Students are being monitored in their own environment by a camera and are tracked by the software to detect signs of suspicious behaviour. The privacy breaches of proctoring software are also visible in recent use cases. For example, Students at the University of Amsterdam filed a lawsuit to prohibit the proctoring solutions because of the breach

Software	Affected values	Explanation
Proctoring software	Academic integrity, privacy, autonomy, fairness, dignity, freedom.	Proctoring software tracks students during an exam to keep an overview and to avoid cheating. However, here academic integrity is at stake versus the privacy and autonomy of the student. The student must record themselves during a test when in their private space and the software examines the behaviour, facial expression, eye tracking, and body language of the student must be fair to avoid false positives.
Automated Feedback systems	Autonomy, humanity, fairness.	Automatic feedback systems provide feedback. They can be unfair and can result in an unfair examination of grades and receiving feedback because the training data might contain biases. Therefore, the systems should be transparent in how the feedback is designed.
Intelligent Tutoring Systems	Fairness, autonomy, privacy, humanity.	Intelligent tutoring systems adapt the learning material to the skills and needs of the student. This has the benefit that the students can learn better. However, the autonomy of the student might be harmed. The students can no longer choose what is relevant and interesting for them. Besides that, the student could also influence the tutor in a way that would harm the learning path of the student by only focusing on one part of the question.

Table 3: Short overview of potential ethical issues of AI in education, the entire list can be found in Appendix D.

of privacy of personal data and protection of private life (De Rechtspraak, 2021). In addition, Utrecht University's data protection officer conflicted with the board of Executives because of the privacy issues of online proctoring software that the University used (Knobel, 2020). Besides privacy issues, proctoring systems track the student to determine suspicious behaviour, this tracking can lead to fairness issues when the software contains bias. For example, students with darker skin tones might not be detected correctly (Baker and Hawn, 2021; Swauger, 2020). This was the case in the lawsuit against the Vrije Universiteit Amsterdam, after Proctorio was used and it did not recognize the student because of their skin colour (Bakker et al., 2022). Holmes et al. (2022) also state that proctoring is an example of automating and scaling up poor pedagogic practices, rather than using AI to develop innovative approaches. The student is being monitored by the system with a feeling of distrust. Besides that, the autonomy of the student is harmed, often the student is required to use Proctorio and cannot choose another option (Nigam et al., 2021). Lastly, the freedom of the student is also limited when using Proctorio (Coghlan et al., 2021). Since it tracks the behaviour of the students by monitoring their body language, eye movements, and facial expressions, students are limited in their movements because the software might flag their behaviour as suspicious.

Queirum is an example of an Intelligent Tutor System (ITS) (Table 3) that can be used to simulate one-to-one personal tutoring (Zawacki-Richter et al., 2019). It uses advanced algorithms to provide customized learning techniques for various students according to their needs and capacities (Akyuz, 2020). However, some potential ethical issues arise with Queirum. Firstly, the loss of autonomy by not being able to choose your learning path yourself, since the path is determined for the student by the system. Secondly, the loss of humanity by using a computer as a tutor more often instead of

learning and interacting with other students and teachers (Akyuz, 2020; Miao et al., 2021). Queirum adapts the learning path to the skills and needs of the student by creating a profile for the student, therefore the system is very personalized and profiles the student. However, this personalisation comes with its ethical issues such as privacy, loss of serendipity, de-skilling, widening commercial influence, and the commodification of education (Ashman et al., 2014). The system needs to collect a lot of data on the student and other students to correctly train the system and know what material is appropriate for the student (Latham, 2022). With the collection of a lot of data, many ethical issues arise. The main concern here would be privacy concerns, as already discussed with Proctorio in the previous section. Students themselves express concerns about surveillance, and the potential intrusion of privacy with learning analytics (Braunack-Mayer et al., 2020). Another issue is that bias in the training data could lead to big differences in the learning environment of students (Latham, 2022).

Automatic Feedback Systems (Table 3), such as *FeedbackFruits*, provide automatic feedback during the writing of an essay, where they improve grammar, sentence structure, citations etc. (Hahn et al., 2021). It allows teachers to focus more on other higher-order skills. However, the use of FeedbackFruits can also lead to potential ethical issues. For example, the system could contain bias and unfairly judge students. Non-native students might be receiving other feedback or more negative feedback because of the other language patterns that may they use. Besides bias, the automated feedback system makes the learning process less personal and reduces human interaction, since there is more communication between the application and the student and less contact between the student and teacher (Tsai et al., 2019). This could harm the student's humanity value and their study experience (Hahn et al., 2021). The automated feedback also has the side effect that it takes away the student's autonomy and dignity, with them not being able to have any influence on what criteria the student is assessed.

3.1 Conclusion

In conclusion, this chapter has shown that public and ethical values might be harmed when using AI software applications in higher education. This chapter has investigated three different applications of how they can cause potential ethical value issues. Proctorio, an online proctoring system, Queirum, an Intelligent Tutoring System, and FeedbackFruits, an automatic feedback system. All these applications have privacy issues, but also humanity, autonomy, and fairness issues. There is a fundamental transformation in the tertiary education sector with the use of these AI-driven applications. Thereby, this chapter has shown that these applications are connected to values and might harm these values. These issues indicate the need for institutions to create good governance for AI applications in higher education to align the educational software applications with our public values and educational values. The question remains how can these issues be approached and how can good governance be created to avoid these issues? In the next chapter, this thesis will look at different instruments that are already in place to help create governance for AI in education and evaluate their governance practices to help avoid the issues mentioned in this chapter.

4 Available governance practices for AI in higher education

Ethical issues can arise with the use of AI applications in higher education. To help avoid these issues, this chapter will investigate what governance practices are available to implement AI in higher education and prevent the ethical issues presented previously. This chapter will aim to answer the research question, 'What governance practices are available to implement responsible AI in higher education?' To answer this question, this chapter will assess what governance tools are available to help create governance for AI in higher education and what actions they recommend. This chapter will also look at what actions SURF recommends to its members in their governance documents and what issues these governance documents focus on.

4.1 The AI ethics landscape for higher education

As discussed in the introduction of this thesis, the past years have seen an increase in the publication of AI guidelines (Algorithmwatch, 2020). Most of the guidelines focus on Artificial Intelligence in general, while only a few focus on a specific domain. This is important since AI ethics is context-dependent (Nguyen et al., 2022). Ethics guidelines that are specified for higher education focus on different issues and practices than guidelines in general or guidelines for other domains. As discussed, the education sector reaches and concerns young people from all layers of society. In addition, there is a power structure between students and teachers. This situation makes the need for good governance more pressing. In addition, Hagendorff (2019) argues in his paper that almost no guideline talks about AI in contexts of care, nurture, help, welfare, social responsibility, or ecological networks. Most of these contexts apply to higher education, making it difficult to approach governing AI in the higher educational sector. This section investigates the AI ethics guidelines that were specifically designed to help the pursuit of ethical and responsible AI in education. This thesis has examined eighteen different AI ethics guidelines. From those guidelines, three ethical guidelines were found that were designed specifically for education and assessed in the upcoming section on what they recommend and if they are suitable to use.

Firstly, AI and education: A guidance for policymakers was published by UNESCO (Miao et al., 2021; Table 4). This guideline offers guidance for policymakers on how to best leverage the opportunities and address the risks, presented by the growing connection between AI and education. The UNESCO guideline focuses on policy and gives an overview of policy responses and policy recommendations for implementing AI in education. Therefore, teachers, educators and students might not find much help in this guideline since it does not provide any concrete advice for these audiences on how to responsibly implement and use AI in education. The guideline mentions four strategic targets or principles for AI in education to help implement the values presented in Table 4. For these principles, they make recommendations on the interdisciplinary planning and intersectoral governance, policies on the equitable, inclusive, and ethical use of AI, develop a master plan for using AI for education management, teaching, learning, and assessment, pilot testing, monitoring, and evaluation, and building an evidence base; and fostering local AI innovations for education.

Guideline	Author	Audience	Values	Recommended Actions	What issues are discussed	How is education incorporated
AI and Education Guidance for policymakers (Miao et al., 2021).	UNESCO.	Policymakers.	Targets for policy: ensuring the inclusive and equitable use of AI in education, leveraging AI to enhance education and learning, promoting the development of skills for life in the age of AI, and safeguarding the transparent and auditable use of education data.	Examples of policy approaches and recommendations for policy. Such as interdisciplinary planning and inter-sectoral governance; policies on the equitable, inclusive, and ethical use of AI; and developing a master plan for using AI for education management, teaching, learning, and assessment.	Some examples of AI in education are discussed with which examples of issues are mentioned. For example, intelligent tutoring systems reduce human contact among students and teachers.	The guideline discusses learner agency with AI application and the impact of AI on the role of teachers, aside from other public values.
Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for Educators. (European Commission, Directorate-General for Education, Youth, Sport, and Culture, 2022).	European Commission, Directorate-General for Education, Youth, Sport, and Culture.	Educators.	Human agency and oversight, transparency, diversity, non-discrimination and fairness, societal and environmental wellbeing, privacy and data governance, technical robustness and safety, and accountability.	Guiding questions per value. For example, for Technical Robustness and Safety: Is there sufficient security in place to protect against data breaches? For Diversity, non-discrimination, and Fairness: Is the system accessible by everyone in the same way without barriers?	Issues are described through educational software applications such as intelligent tutoring systems and online proctoring.	Considers its audience and explains AI in an accessible manner. Also, it focuses on competencies necessary for schools and educators to discuss ethical AI.
The Ethical Framework for AI in Education (The Institute of Ethical AI in Education, 2020).	The Institute of Ethical AI in Education.	Leaders and practitioners in educational settings.	Achieving educational goals, Forms of Assessment, Administration & workload, Equity, Autonomy, Privacy, Transparency an accountability Informed Participation, and Ethical Design.	Checklist for pre-procurement, procurement, monitoring and evaluating implementation	No issues are described.	Considers educational values: Respect for achieving educational goals, forms of assessments, and administration and workload.

Table 4: Short overview of potential ethical issues of AI in education, the entire list can be found in Appendix D.

The focus of the recommendations is mostly to assess the benefits of AI, explore how AI can improve education and how the literacy of AI can be improved and stimulated. For example, recommendations are given such as test and deploying AI technologies to support the assessment of multiple dimensions of competencies and outcomes or delivering skill sets that teachers need to search for and apply AI tools in their design and organization of learning activities and their professional development, without specifying how these recommendations can be approached.

Because of this focus on policy, the recommendations focus little on how to address potential issues in AI and other important values of education. In addition to this, the recommendations remain abstract on how they can be approached. For the principle of inclusive, equitable, and ethical use of AI, they recommend for example to create AI applications that are free from gender biases and ensure that the data used for development are gender-sensitive, without offering any tools to achieve that. Given the evidence presented here, it can be argued that the UNESCO guideline is not helpful for direct application since it does not provide any concrete guidance for educators or any readily applicable tools to ensure the implementation of responsible AI or to create good governance for AI in educational software.

Secondly, the European Commission, Directorate-General for Education, Youth, Sport, and Culture published the Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for Educators (2022; Table 4). The guideline explains AI to teachers and argues that AI applications can lead to harmful consequences. It also argues that it is important that teachers can ask the right questions when using and implementing AI in their classrooms. They do this by stating ethical considerations: human agency, fairness, humanity, and justified choice. Next, they introduce seven key requirements for trustworthy AI that will be the basis of the guiding question they propose: human agency and oversight, transparency, diversity, non-discrimination and fairness, societal and environmental well-being, privacy and data governance, technical robustness and safety, and accountability. To make sure that these principles are met, the guideline provides critical questions and example scenarios on when and how educators can ask questions to help enable constructive dialogue when using and implementing AI in their classrooms. However, these questions do not close the gap between principles and practice (Mittelstadt, 2019; Munn, 2022). The questions remain abstract and require educators to have literacy about AI to be able to understand the question and the answer. In addition to this, for educators, it is also difficult who ask these questions and to what extent educators can influence the applications that are used in their institution, aside from the applications they use in their classes. Besides that, the only tools that the guideline offers to help apply the principles, are the guiding questions and their examples, other concrete governance instruments that can be used are not provided. Given the evidence presented here, it can be argued that the ethical guideline on the use of AI and data in teaching and learning for educators is not helpful for direct application. The guideline does offer questions, but it remains vague about who should ask these questions to whom, when these questions should be asked, and eventually what can be done if an answer has been given.

Lastly, the Institute for Ethical AI in Education (2020) created the Ethical framework for AI in Education (Table 4). This framework contains objectives with explanations and a criteria checklist with guiding questions that can be used to see how ethical an application is to use in education (Table 4). The Institute of Ethical AI in Education was founded by the University of Buckingham and was funded by McGraw-Hill, Nord Anglia Education, Microsoft, and Pearson (The University of Buckingham, 2023). McGraw-Hill

is an American learning publishing company that provides educational content and software (McGraw Hill Higher Education, n.d.). Nord Anglia Education is a school provider that provides global learning experiences for its students (Ecoff, n.d.). Microsoft, as earlier mentioned in this thesis, is a software provider. Lastly, Pearson is a supplier of learning materials (Plc, n.d.). The introduction of this thesis mentions that developers themselves are also promoting and publishing ethical guidelines for the use of AI. There are large attempts on the way to prevent regulation by regulators by setting up self-regulation initiatives (Bietti, 2020). Although the Institute is transparent on how it received its funding and had demands that must be fulfilled to accept funding (The University of Buckingham, 2023), it does appear that the Institute of Ethical AI in Education is such an example.

Another issue is that the guideline does not discuss any issues with AI in education, which does not make it clear why the questions they propose need to be asked. Besides that, the questions that are proposed are not put into context. The guideline from the European Commission, Directorate-General for Education, Youth, Sport, and Culture (Table 4), did provide examples for how and when to ask the questions, but the AI ethics guideline for education from the Institute of Ethical AI in Education does not do this. Making it unclear when and how the questions should be asked. Thereby, the only concrete governance instrument or practice that was given here are the guiding questions to help implement the values that were given. These guiding questions do not provide many tools for readers to help govern responsible AI in education. What is interesting, however, is that this guideline is the only one out of the three guidelines that were analysed to make sure that AI applications that are going to be used in education, should be used to achieve educational goals and to assess and recognise a broader range of learners' talents. Given the evidence presented here, it can be argued that the ethics guideline from the Institute of Ethical AI in Education is not helpful for direct application. Although the guideline respects educational values, it does not discuss any issues that can arise with the use of AI in educational software and does not provide any concrete guidance on how to use the questions that are presented and how the answers can be used to create good governance for AI in educational software.

In conclusion, there were only three guidelines found that were designed for AI in education. The little focus on education in the AI ethics guidelines and governance tools is an issue since AI is highly context-dependent (Nguyen et al., 2022). Besides that, the guidelines that have been published and discussed in this chapter have their issues, such as the lack of applicability of the principles or questions they propose, the wrong audience for its guidelines, the absence of important educational values, and the potential of ethics washing in the guidelines. These issues make it difficult to use these guidelines or make them unsuitable to use. The following section will further elaborate on the issues that have been shown here.

4.2 Issues of AI ethics guidelines

In the previous section, different AI ethics guidelines for education were discussed for their governance approaches. However, it was shown that there are some issues with these guidelines. This section further discusses the issues of the AI ethics guidelines that are available to higher education institutions.

Principles and guiding questions that are suggested in AI ethics guidelines can be vague or abstract. That is what occurred in the guidelines of the European Commission, Directorate-General for Education, Youth, Sport, and Culture (2022) and the Institute

for Ethical AI in Education. The guidelines state principles or requirements, but the principles do not match between guidelines. This is what Jobin et al. (2019) show in their literature study on AI ethics guidelines. From the eighty-four documents they analysed, no single ethical principle is common across the entire corpus of documents. Fjeld et al. (2020) also did inventory research on principled AI ethics guidelines and argued for the lack of consensus between the ethics guidelines. Often, the principles proposed in these guidelines are fuzzy or ambiguous and could entail multiple meanings (Munn, 2022). In addition, the guidelines are not explicit on their notion of ethics. Franzke (2022) argues that most of the AI ethics documents do not mention their definition of ethics which makes it difficult to comprehend the point of view the author has when discussing AI ethics. This contributes to the abstractness and vagueness of these guidelines.

Another issue is that the methods of translating principles into practice or concrete governance instruments have so far not been thoroughly researched in AI ethics (Mittelstadt, 2019). Mittelstadt (2019) draws a comparison with the medical field, where there are professional boards and ethics review committees, peer self-governance etc. AI development does not yet have comparable practices to translate principles in real-world development contexts as in the medical field. This gap between principle and practice is often recognized (Munn, 2022), for example, in the AI ethics maturity model Krijger et al. published (2022). However, recognizing the gap between principle and practice does not necessarily help bridge it. Canca (2020) argues that the translation of principles to applied ethics might be difficult, but it helps to divide AI principles into core principles and instrumental principles. Thereby, it can be made easier to make ethical considerations between AI principles, by weighing instrumental principles to determine which to prioritize and how to use them to best achieve the core principles.

Besides to the discussion on how to bridge the gap between principle and practice, there is a discussion about whether the principled approach is the best way to govern AI. As discussed in the previous paragraph, the principles are vague, and it is not always clear what they entail. Mittelstadt's (2019) comparison between principled AI ethics and medical ethics principles, shows that AI ethics lacks a common goal, users of AI systems cannot trust that developers will act in their best interests when implementing ethical principles in practice. What makes this even more clear, is that AI is seen as a revolutionary innovation and that regulations will disrupt this innovation (Munn, 2022). In addition, Munn (2022) argues that the vagueness of AI ethics principles could even facilitate box-ticking and allow companies to claim adherence to a set of principles without engaging in reflection. Besides that, Canca (2020) argues that AI principles are a list of fundamentally and instrumentally important ethical considerations but not a complete system for complex decision-making. They can help but can only do so much in creating good governance for AI in educational software. Furthermore, AI ethics miss legal and professional accountability mechanisms. AI development does not have comparable professionally or legally endorsed accountability mechanisms, as with the medical field. Mittelstadt (2019) argues that a long-term commitment to self-regulatory frameworks cannot be taken for granted.[2]

It can be concluded that there are attempts to develop good governance for the higher education sector. However, the current guidelines miss the translation to the application to help construct good governance for AI in educational software. This con-

[2]Another issue in the AI ethics guidelines is underrepresentation in the debate of AI ethics. Jobin et al. (2019), Corrêa et al. (2022), and Franzke (2022) both show that areas such as Africa, South and Central America, and Central Asia are not participating equally in this debate. The ethical principles that are represented in are mostly Western principles and ideas. Therefore, ethical principles with other ideas than Western are more difficult to implement since there are underrepresented in the ethical guidelines to help implement them.

clusion is supported by the researchers mentioned in the section above. The following section will discuss how organisations in higher education are dealing with this issue.

4.3 How do organizations react to the challenges of AI in educational software?

In the empirical fieldwork at SURF, several initiatives were noticed that were developed to tactically address the challenges of AI in educational software. Since the previous section concluded that there are not yet any applicable guidelines for how to create good governance AI in educational software, SURF is reacting to this need in several ways. Here are a few examples of how SURF is reacting to the challenges of AI in educational software.

Firstly, SURF has set up a public values team to promote public values to their member institutions and also within SURF as an organisation. They promote public values by stimulating debate surrounding public values in education and research and stimulating institutions to think about what they think are important values to maintain in their institution. This is done according to the value register SURF created together with Kennisnet (SURF & Kennisnet, 2021) accompanied by a public values dilemma game that employees from the team often play at institutions (SURF, n.d., e). In this value compass, three values are put in the centre: humanity, autonomy, and justice. Humanity means having consideration for the human aspect in the education sector, such as social cohesion, meaningful contact, respect, safety, health, and well-being (SURF & Kennisnet, 2021). Autonomy means to live under your own laws, it comprises values such as self-determination, safeguarding of personal privacy, and educational independence and freedom (SURF & Kennisnet, 2021). Lastly, justice comprises concepts such as equality, inclusivity, and integrity (SURF & Kennisnet, 2021). The game is based on the Moral Design Game (Fontys, 2022) and suggests possible dilemmas of digitalisation in higher education. Besides stimulating debate around educational and public values, the public values team also has a Mastodon pilot to explore open-source platforms for education and research in the Netherlands to better express public values (SURF, n.d., c). This pilot serves as an exploration for an alternative for other non-open-source platforms.

Another response has been that SURF has created a responsible AI team within the AI program of the innovation department. The innovation department focuses on the innovative role of SURF by exploring how new technologies can be applied to higher education and research and can be transformed into a new service that SURF can offer to its members. As of November 2023, the responsible AI team exists of 1.5/2fte and is slowly growing. The team focuses on exploring the potential of AI in research, education, and operations, considering ethical principles and public values within SURF and with members. Issues that the team focuses on are environmental issues, privacy issues, data ownership, autonomy, academic freedom, and more, which will be discussed further in this section. The responsible AI team is also involved with other AI projects at SURF and advises on how to approach AI responsibly. For example, they are involved in the algorithm register project that aims to register algorithms used in education (Vermaas, 2023). The project is as of November 2023 in its exploring phase on how the creation of an algorithm register can be approached. For example, institutions may procure systems from third parties, meaning that they have no insight into how exactly the system works or how the algorithm operates and what exactly are the demands for an algorithm to be registered. Another project that the responsible AI team is involved in is the Dutch large language model project together with TNO and NFI (SURF, 2023). This project

is a response to the growing interest in large language models and SURF is attempting to build a Dutch alternative to use in higher education and research.

More generally, because of the growing interest in AI, SURF has noticed many members requesting their help with using AI. They receive questions about how to use it within the education sector, what tools can be recommended and how to create governance for AI in educational software. In response to these questions, SURF is increasingly organising webinars to help answer these questions about AI and posting blog posts on their community website to help answer questions and show the possibilities of AI in higher education.

To further assess SURF's reaction to the challenges of AI in higher education, their governance documents were analysed to see what issues SURF is addressing and how SURF is advising solving or mitigating these issues. This analysis was done by creating an inventory of all governance documents from 2016 that SURF has developed. These documents were found on the SURF site and the communities' site where SURF and its members can post blogs about different topics. A requirement was that the documents must be accessible to their member institutions. In total thirty-two governance documents were found and analysed (Appendix C). The table of governance documents was compared to the table of issues of AI in education (Appendix D), to see what issues SURF is addressing in their governance documents. Figure 1 shows the frequency of the issues that SURF addresses in their documents. This is not a qualitative evaluation of the issues but indicates merely how often an issue is mentioned not how urgent it is. There might be issues which are more relevant and should be addressed more frequently but are not.

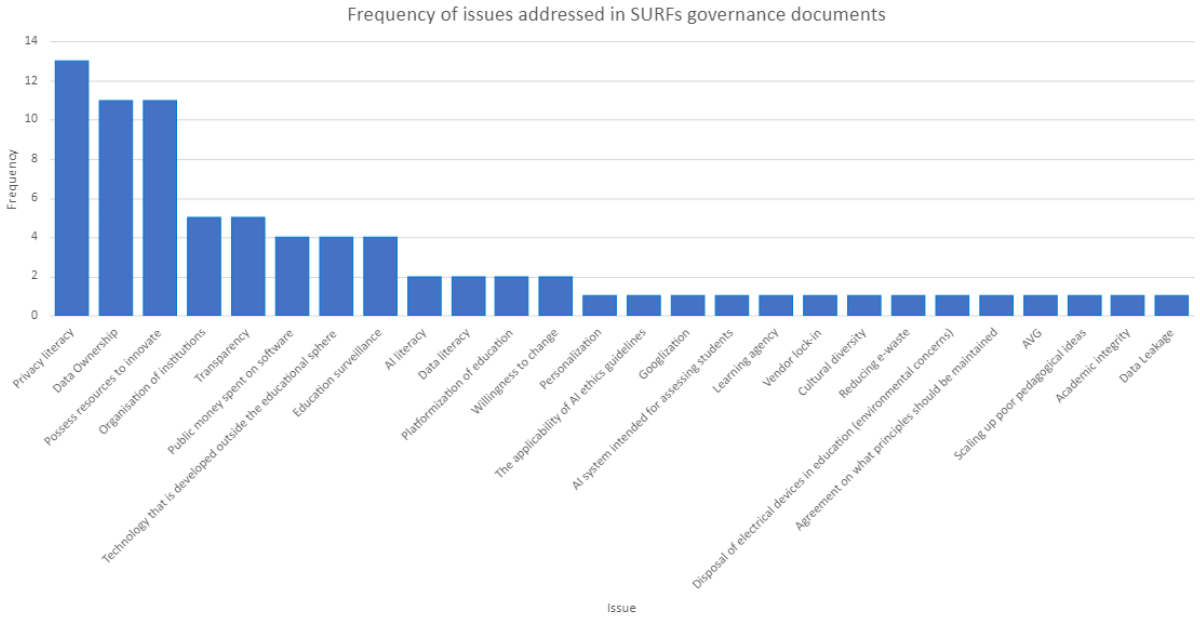

Figure 1: Frequency of issues addressed in the governance documents of SURF based on Appendix C.

Privacy literacy, data ownership, and the possession of resources and knowledge are the most frequently named issues that SURF focuses on in its governance documents (Figure 1). From Figure 1 it can be concluded that SURF mainly focuses on privacy and security issues within IT and AI systems. What is interesting here is that the issues SURF focuses on are not necessarily only AI issues. But more general IT issues. While they do focus on privacy issues of online proctoring software in their white paper (Sietses,

2020), other issues that were mentioned in the second chapter of this thesis, such as bias in proctoring systems, or the loss of humanity with intelligent tutoring systems, are not issues that SURF addresses in their governance documents. The documents are therefore also representative of the organisation's awareness of certain ethical issues while others might be neglected.

To answer the question of this section, the actions that SURF recommends in their governance documents must also be analysed. In other words, what governance practices does SURF offer to its members? From the actions that are recommended in these governance documents (Appendix C), the following governance practices or approaches can be concluded from the documents that SURF has published:

- Stimulating debate by helping to ask the right questions and sharing opinions.
- Providing recommendations, such as examples, and recommended practices, or showing how to apply guidelines themselves.
- Providing norms or requirements that are recommended to implement.
- Providing checklists or step-by-step route planners.
- Provide MVI (Corporate social responsibility procurement) criteria.

These practices help their members to better approach issues in AI and create good governance for AI in educational software but are not sufficient. More concrete instruments or tools that could help institutions govern AI in educational software could be beneficial. To see how and where organisations such as SURF can improve their governance practices will be discussed in the following chapter.

4.4 Conclusion

This chapter has discussed the AI ethics landscape for higher education and has argued that the guidelines that are available to create good governance for AI in educational software are not sufficient. Few AI ethics guidelines focus on higher education which is an issue since AI is highly context-dependent and the education sector has specific values that must be considered.

The guidelines that are available for higher education are also not sufficient. Since they focus on the wrong audience for their guidelines, they miss the applicability of the principles they propose, they are absent of important educational values or there is a potential of ethics washing within the documents. Therefore, it can be concluded that while there are good attempts to govern AI in educational software, there are not yet concrete practices available in higher education to create good governance for AI in educational software. This chapter has shown how organisations in the education sector are reacting to the need for governance for AI, presenting the need for more concrete governance tools. The following chapter will identify possible good governance practices to help construct policy for AI in educational software and help avoid ethical issues.

5 Good governance for AI in educational software

The previous chapter of this thesis showed that there is a shortcoming of good governance that is readily applicable to AI in higher education. The guidelines of UNESCO (Miao et al., 2021), the Institute for Ethical AI in Education (2020) and the European Commission, Directorate-General for Education, Youth, Sport, and Culture (2022), were analysed. It was shown that these guidelines are not readily applicable to help implement responsible AI in educational software. The guidelines focus on the wrong audience for their guidelines, they lack applicability of the principles they propose, or they have the potential of ethics washing. In addition, these guidelines do not consider the values that are already present at institutions and do not provide concrete enough applications to solve these issues. To solve the shortcomings of concrete governance practices for AI in educational software, this chapter will investigate how good governance can be approached for AI in educational software. This will be done by answering the research question, how can good governance be approached for AI in educational software? This question will help show how and where organisations can improve their approach to good governance for responsible AI. This question will be answered by examining where industry and sector branches or organisations can help to create good governance and what institutions themselves must take into consideration when creating good governance for AI in educational software.

The ethical guidelines in the previous chapter are missing a structured manner to help implement and use governance instruments. This chapter will aim to provide structure to these governance instruments by using a layered approach to governance (Table 5). This will help show what each level is capable of, what instruments are available and how these can be implemented. In addition, this approach will also help to show that AI can be considered a system technology. As discussed in the introduction, AI as a system technology means that AI will be a technology that will affect every part of a system in society, just like a steam engine or a car (Wetenschappelijke Raad voor het Regeringsbeleid, 2021). This implies that AI will also affect every layer of educational institutions (Stichting Kennisnet, 2023). Therefore, this chapter will look at the possibilities to approach good governance at each level.

Level	**Example policies**
EU, Dutch Government, OCW	GDPR, AI Act, DMA
Industry and sector branches: UNL, VH, SURF, NLdigital, IEEE, Kennisnet	Practical guidelines, procurement rules, Algorithm register
Individual institutions	Committees, OER regulations, guidelines for data

Table 5: Levels of governance.

The highest level induces policy from an international or national layer. For example, regulations and legislation from the EU or the Dutch government such as the GDPR, the upcoming AI act or guidelines from the ministry or European Commission. The policy created at this layer must also be complied with at the lower layers. However, since the research question of this thesis does not necessarily focus on the EU and governmental layer, this will not be elaborated on further.

5.1 Industry and sector branches

Next to the national level of policy creators, organisations also create guidelines and frameworks for the sector as a whole. At this level, the frameworks and operational capacities for the higher education sector are created. The parties that create policy or provide policy instruments within this layer are for example, SURF which provides the IT infrastructure for higher education, VH which is the Association for Schools of Applied Sciences, and UNL which is the Association for the Universities within the Netherlands (Table 5). These organisations contribute to the translation and adaptation of regulations and help educational institutions by providing them with guidance on creating governance. For example, the UNL has guidelines on how research should be done (Universiteiten Van Nederland, n.d.). Another example is the guidelines SURF produces, as shown in the previous chapter, such as privacy and ethics for educational data. These organisations can help guarantee that the general educational values within higher education, such as autonomy, the independence of students, freedom of education, justice and humanity are being valued in higher education. These values can be guaranteed through the governance structures that these organisations provide. However, the organizations cannot completely provide concrete guidelines for the educational institutions, since they need to be applicable for all the different institutions that all have different values and visions. Therefore, the guidance that they can offer must in a sense remain abstract, such that institutions can give their interpretation and additions.

Firstly, the sector organisations can give their interpretation and conditions for the educational sector on how AI should be used. This is the first translation of regulation that is made for the sector. Here the educational values can be formulated and maintained within policy frameworks. The sector organisations can state demands that AI applications and institutions implementing these AI systems should abide by. For example, as stated before, the UNL has codes of conduct, for example on scientific integrity, the usage of personal data, and good governance (Universiteiten Van Nederland, n.d.). SURF has organised the HOSA, which provides the sector architecture for higher education. This sector architecture contains frameworks that help suppliers of the common information and technology facilities develop and deliver these facilities (SURF, n.d., d). The codes of conduct and the HOSA can provide more structure and concrete interpretation of the boundary conditions of AI in educational software. There could be codes of conduct or principled conditions for the use of AI in software for the education sector. For example, these conditions could advise institutions to use impact assessments when implementing new software or the continuous monitoring of AI systems.

Besides the codes of conduct, these sector organisations can advise institutions to implement an algorithm register. An algorithm register can be used to help contribute to the transparency of AI in educational software. An algorithm register provides more transparency that will help show where potential issues might be and help users decide whether to use an algorithm or not. It also helps to determine what values are important that an institution might want to maintain. Because these organisations operate for the sector, they can impose standards for an algorithm register. They can create a format on how the register should look like and what information it needs to capture. For example, the algorithms or software applications that are used are registered with information such as how they operate, what decisions they make, what data is used, and who is responsible. It helps create more clarity in a system and shows how a system operates. An example of an algorithm register is the Dutch government. They created a guide to their algorithm register to show what choices they made in their register (Ministerie van Binnenlandse

Zaken en Koningsrelaties, 2023).

Besides an algorithm register, these sector organisations can also advise the use of an AI audit to monitor the implementation of a software application. An AI audit provides more transparency of the software applications that are used in higher education. In an institution, the data, models, outputs, and processes that are used in an AI application can be audited to give insight into how these systems operate and if they harm any values. It helps to see how an AI system is operating and if there are improvements that must be made. An AI auditor evaluates software or systems according to a specific set of criteria and provides findings and recommendations (Constanza-Chock et al., 2022). In their research, Constanza-Chock et al. (2022) show that in theory, an AI audit can help identify whether algorithmic products and systems meet or fall short of expectations in the areas of values that an institution maintains, but these are difficult to exercise without a clear understanding of audit practices. There is little consensus yet on the proper way to design and conduct an AI audit since many AI audits focus on the technical implementation of principles and do not treat AI as a socio-technical system with consequences in a wider context with socio-economic impacts (Constanza-Chock et al., 2022). The sector organisations can set the norms and standards for an AI audit and decide what information on algorithms needs to be audited. For example, SURF already has audits for privacy (Appendix C). While the sector organisations are able to set the standards and formats of an algorithm register and an AI audit, they must be implemented and executed at the institutional level, which will be discussed more elaborately in the following section.

Secondly, a good approach to help institutions govern AI would be to help with creating standards for procurement. A set of requirements or rules can help procure software for higher education that uses AI technologies. SURF already does the procurement for educational software for its member institutions and provides licenses for educational software. However, as discussed in the previous chapter, the procurement rules do not consider other values aside from privacy and security. Additionally, as shown in the second chapter of this thesis, more values are being harmed by using AI software applications in higher education. Therefore, the procurement rules need to be adapted to deal with the increasing risks of other values being harmed. For example, in the procurement of proctoring software, requirements can be stated that the software must agree with. Such as the values of the higher education sector. The requirements or standards for procurement can help decide whether to procure new software. In addition, procurement rules or requirements could provide a more concrete option for maintaining the quality of new applications and aim to mitigate potential issues that could arise with AI systems.

The guidelines that were discussed in Chapter 3 did provide some guiding questions for procuring AI systems, these questions could be elaborated by adding other values and requirements needed for the implementation of responsible AI in higher educational software. These documents could facilitate a basis for new requirements for software with AI technologies. There are already procurement guidelines for AI, but these are not yet altered to the needs and values of the higher education sector. For example, the guidelines for AI Procurement (World Economic Forum, 2019) guide public procurement of AI. These guidelines are missing the relevant questions needed for procuring in higher education such as data storage and access, information on how the software was trained, and model cards that can be added to create more complete procurement requirements for AI in educational software.

Another option for helping procure educational software could be to formulate design requirements. This helps create responsible software that aligns with educational

values. This can be done by demanding design requirements, model cards, or internal audits. Design requirements help to implement values into a system during the development phase. They state characteristics that a design must meet to be developed, for example, educational values such as accessibility, equity, privacy etc. (van der Poel, 2013). This way potential issues are being mitigated in the development process of a system. Model cards provide short context to how the system that is developed is intended to be used, how it is trained, what technologies are being used and other relevant information. It helps contribute to the transparency and explainability of a system (Mitchell et al., 2019). SURF already has a checklist for the development of new services that SURF develops to make sure that privacy and security are being maintained. This list must be extended with other norms and principles that are necessary for the implementation of responsible AI within educational institutions.

Thirdly, the industry and sector organisations have the strength to act as a collective. This ability to act as a collective can give strength to adapt and change applications to fit educational values. This strength can for example be seen when in 2022 SURF caused Zoom to announce major changes to its data protection practices and policies after months of intensive discussions (Singer, 2023; SURF, 2022, b). This portrays how these organizations are able to influence the values that are being secured by using governance instruments, such as impact assessments. By conducting an impact assessment, organisations such as SURF can be more assured that the values of higher education are being valued.

The previous point already stated that these organisations can help with the procurement of educational software. This is possible since the organisations collectively bundle the needs of the educational institutions. Acting as a collective opens more possibilities, such as demanding educational values to be valued within educational software through using procurement rules, impact assessments, developing software using value-sensitive design etc. Another opportunity for the organisations to act as a collective is to communicate with policymakers about the needs of educational institutions. Besides that, the organisations that operate in the education sector can also help with the training and upskilling institutions regarding AI possibilities, implementations, and governance. For example, they can help to make sure that every teaching and learning centre of the institutions is trained and skilled or they can help policymakers at institutions see the potential harms of AI and be able to adjust policy.

5.2 Educational institutions

The individual institutions must create policies to govern AI within their institutions. The regulations and guidelines that are created at the national level and within the industry and sector organisations also apply to individual institutions. Individual institutions can give substance and translation to the regulations from the other levels. Here the values that institutions might additionally have can be accounted for in additional governance. This entails that the regulations must be translated to fit the needs and values of individual institutions. To give structure to this translation, this section will provide an overview of governance instruments that can be used to help with this translation and create good governance for AI in higher educational software.

Every institution has its own culture and values that it wants to maintain within its policy and education. Even within the Netherlands, differences can be seen between institutions. For example, in 2023 students protested at different universities against the cooperation between universities and fossil fuel companies. Universities reacted differ-

ently towards the protests. The University of Amsterdam involved the police to remove the students from the building (NOS, 2023). On the other hand, Utrecht University allowed the students to protest and discuss with the students about a suitable approach (Universiteit Utrecht, n.d.). In addition, these differences in values can be seen in the mission and values statements of institutions. It influences how institutions translate and implement regulations and create governance. This translation and implementation now need to happen for AI in educational software.

Regulations and guidelines are given at the national level and from the organisations that operate for the sector. Institutions then must create their policy surrounding these regulations and add their own needs and values. For example, the GDPR was induced from the national level and provided legal frameworks. However, within this framework, ethical choices were made by institutions to implement GDPR to fit additional values. This translation must also be done for AI in educational software. In some instances, institutions are relatively quick to make ethical choices for legal frameworks. For example, when ChatGPT was introduced, many institutions created policies to frame ChatGPT within their existing policy infrastructure (Scharwächter, 2023). However, these policy adaptations are reactive to the sudden release of ChatGPT. When creating good governance for AI in educational software, more strategic policy decisions need to be made. The translation must be made according to the vision and mission of an institution. These provide support for recognizing the values that an institution wants to maintain. Stichting Kennisnet (2023) applied the concept of AI as a system technology to individual institutions. Every level of an institution will be affected by AI, the school management, the education, the educational support, and even the business operations of an institution. Therefore, it is important that at every step assess what AI will mean and how the values at every layer can be complied with. The policy that an institution develops needs to recognize that AI will affect every part of an institution. Below are the steps that policymakers within institutions need to consider with suiting governance instruments.

When procuring or developing software, procurement rules can be used to decide whether to procure a specific software system. The procurement rules can be adapted from sector organisations and adjusted to fit the specific needs and values of an individual institution. In addition, since SURF procures educational software, institutions can also decide whether they want to use these software applications. Procurement standards were also suggested for the organisations that provide for the higher education sector. However, individual institutions can also procure software themselves. Therefore, the procurement rules that are for example formulated by SURF can be adapted and translated to fit the educational values of the specific institution to fit their needs. Box 1 portrays an example of how the procurement of proctoring software can be approached.

Procurement proctoring software.
When deciding to implement proctoring software, procurement rules could be used to make sure that the proctoring software does not harm any values. The question needs to be asked if the procurement aligns with institutional strategies. For example, if the mission of an institution is to put the student central, then using proctoring software might undermine that mission.

It could be that SURF has already done the procurement for the software. In this case, SURF already procures proctoring software. An institution must decide whether they want to use the software and if they agree with the procurement rules SURF uses.

Box 1: Example of how the procurement of proctoring software can be approached.

Aside from the procurement rules, an impact assessment can be executed to decide

whether to use a specific software application. In addition, an impact assessment can also be used to evaluate AI systems that are already being used in an institution. It helps to calculate the risks and benefits of an application by envisioning the entire ecosystem in which the application is being implemented and it helps capture the thought processes that will help with accountability, quality, and reproducibility (Stahl et al., 2023). Therefore, impact assessments can be a good tool to determine the benefits and risks of values that could be harmed by new software or to help assess software that is already being used. Stahl et al. (2023) made an inventory of different AI impact assessments. Examples are the IAMA (Gerards et al., 2021) and the DEDA (Franzke, Muis, Schäfer, 2021). What is important is that impact assessments must be tailored to fit educational values, since it has already been stated that the application of AI systems is context-specific. Box 2 shows an example of how an Impact Assessment can be used for the implementation of proctoring software.

Impact assessment proctoring software.

An impact assessment can be used when deciding whether to use proctoring software in a course. With an impact assessment, the values that an institution wants to respect can be accounted for, by asking what values might be harmed and calculating the impact of a proctoring application. For example, the inequality of students with darker skin might not be recognized by the facial recognition system within the proctoring software. The impact assessment can also help decide what the trade-offs are for implementing a proctoring system and help make an informed decision, for example, privacy and fairness against academic integrity. In addition, an impact assessment also can establish the decision-making process of an institution when implementing proctoring software.

What is important to note regarding impact assessments, is that currently in the AI Act high-risk software applications require an impact assessment to be used (European Parliament, 2023). For example, proctoring software can be classified as a high-risk application since it is collecting personal data and false positives might have severe consequences. Therefore, it is important to use impact assessments when procuring or developing a new AI application.

Box 2: Example of how Impact Assessments can be used for the implementation of proctoring software.

When an application and the surrounding policy are developed or implemented within an institution, the application and the policy must be monitored. For example, how the software is being used within the institution, whether there are any errors or mistakes that occur with the use of the software, if the policy provides enough guidance regarding the application, or how the students experience the application, are questions that need to be answered. To have insight into these questions, different governmental bodies within an institution should be arranged. However, it is important to remember that there are already governance instruments available within institutions, and the wheel does not have to be re-invented. Within institutions, there are already bodies of ethical groups, supervisors, ombudsmen, data protection officers, information, and technology services (ITS) directors, etc. These can be additionally arranged to fit the effects of AI. Since AI can be considered a system technology, all layers of an institution will have to account for the impact AI will have and the values that might be affected. As with the implementation of the GDPR, organisations and institutions need to be arranged to execute this policy. For example, for GDPR privacy officers were introduced. This now needs to happen for the AI Act or AI in general. Box 3 shows an example of the steps that need to be thought through from implementing a proctoring software application.

Implementing proctoring software.
If proctoring software will be used in an institution, procedures must be established to ensure it is implemented responsibly. Records need to be made, for example about what decisions the proctoring software will make, if a teacher will still have the final say in the decision-making process of the software, if it is allowed in all courses or only in special circumstances, etc.

Procedures also need to be established about how is communicated about the proctoring software. It must be clear where information can be found, where errors can be reported, who is responsible for the use of the software, etc. The communication about the usage of the proctoring software must also be established. Do students have to create an account or does the institution provide one? If a student experiences issues with the proctoring software, such as discrimination, where can they go? Who is responsible when the software makes an error? These are all questions that need to be answered to responsibly implement proctoring software.

Box 3: Example of implementing proctoring software within an institution.

When an AI application is implemented, the application needs to be monitored and evaluated. One example to do this is to implement an algorithm register. As mentioned before, an algorithm register can be used to help contribute to the transparency of AI in software. It also helps to determine what values are important that an institution might want to maintain. The sector organisations are able to create a standard format for an algorithm register. As mentioned in the previous chapter, SURF is beginning an algorithm register project to help create more transparency of AI in educational software and systems (Vermaas, 2023). This is convenient since it will help individual institutions give more clarity and guidance on what information should be registered. However, each institution has its own additional norms and values that may not necessarily be captured in the algorithm register that is created at the industry level. Therefore, an additional translation step is necessary to also capture the values of an institution. Box 4 shows an example of suggestions for the information that can be registered in an algorithm regsiter for a proctoring software application.

Algorithm register proctoring software.
An algorithm register can be used to get more transparency about the proctoring software. It can include a description of the software, what data the proctoring software uses, if the proctoring software is self-learning, what decisions the proctoring software makes, who is responsible for the proctoring software, what is the purpose and impact of the proctoring software, if an impact assessment was done when implementing the software, where can students or teacher for asking questions, how it is decided when suspicious behavior is flagged, when was the last audit executed etc. The algorithm register helps to get a better overview of where AI is being used in educational software and what decisions it makes.

Box 4: Example of registering proctoring software in an algorithm register.

Another monitoring tool that can be used to monitor AI in educational software is an AI audit. As discussed, an AI audit provides more transparency of the software applications that are used in higher education. In an institution, the data, models, outputs, and processes that are used in an AI application can be audited to give insight into how these systems operate and if they harm any values. As with an algorithm register, the sector organisations are able to create a standard for an AI audit. However, there may be a difference in values between institutions that may be captured when using an AI audit at the institutional level. Therefore, an additional translation step is necessary to ensure that the audit registers the additional values an institution might have. An example of an AI audit that could be adapted, is the digital toetsingskader algoritmes (Algemene Rekenkamer, 2020). This framework translates norms into practical guidelines and can be adapted to fit additional values institutions might want to account

for. Box 5 shows an example of how an AI Audit can be used to audit a proctoring software application.

AI audit proctoring software.
An AI Audit can be used to see if a proctoring software application works properly. During the audit, an auditor investigates if the proctoring software satisfies the norms and the criteria that were previously established. For example, if it correctly flags suspicious behavior during exams or if the software is profiling students. The audit shows if there have been any issues with the software and if any values have been harmed by the implementation of the proctoring software. With the result of an AI audit, feedback can be given about the implementation of the proctoring software or the developers of the software.

Box 5: Example of an AI Audit for proctoring software.

5.3 Conclusion

This chapter has provided a more structured approach for applying governance instruments to help create good governance for AI in educational software. This helps answer the question of how good governance can be approached for AI in educational software. The governance instruments were organised by the level of their policy. First overarching sector parties were examined, such as SURF, UNL, and VH. The strength of these parties is that they act as a collective for the educational sector. Therefore, they can create boundary conditions for using AI in educational software, create norms and standards for algorithm registers or AI audits, they can formulate codes of conduct for using educational software, help with the upskilling of knowledge about AI applications within educational institutions, and communicate the needs of the education sector to policymakers and developers of educational software.

Secondly, the individual institutions were examined, to investigate the process of creating policy and implementing and evaluating educational software. It was stated that institutions need to formulate their translation and implementation of the policy and guidelines given at the national level or by sector organisations. When deciding to use educational software with AI technologies, procurement standards can be formulated to ensure that the software aligns with the values of the institutions. In addition, an impact assessment can be done to decide on the impact of the software and to see what values might be harmed. When implementing the software policy decisions need to be made about the implementation and the communication about the software.

Finally, the educational software that is being used needs to be monitored and evaluated. This chapter suggested an algorithm register to have documentation of what systems are being used and what decisions they make. In addition, AI audits can be performed to evaluate if the educational software is correctly implemented and functioning according to the demands stated when procuring and implementing the software application.

6 Conclusion

AI can be considered a system technology since it will cover all areas of our society. Therefore, the need for AI ethics and governance is increasingly relevant. In addition to this, the upcoming AI Act from the European Commission pushes organisations to action with the creation of AI governance. However, the AI Act only provides the groundwork for the implementation of good governance. Therefore, this thesis proposed the research question, how are organisations in tertiary education sections developing good governance for AI?

This thesis has shown that AI in educational software contains values, but that it can also harm them. These values are especially relevant within the education sector. The education sector concerns young students from all layers of society who deserve extra protection. Therefore, it is important that every organisation within the education sector formulates their position and their technology governance accordingly. While there have been attempts to help create good governance for AI in educational software, work is still to be done. Every organisation has a different nuance in their value opposition. With the creation of governance, this nuance can be translated into practice.

In addition to the initial reason to create good governance for AI in educational software, in a recently published opinion piece by leading scholars José van Dijck, Natali Helberger and Corien Prins (2023) the claim was made that the AI Act falls short in several instances. This shows that the legislation only provides the groundwork for the creation of governance. They argue that the Netherlands has to do better and find ways to create governance for AI. This thesis argues the same counts for the education sector and the educational software that is being used and implemented. Institutions have to shape their governance of technology according to their value proposition; the law will only provide a minimum requirement.

Artificial General Intelligence (AGI) has not been a topic this thesis has discussed. However, the increasing use of AGI within educational applications only pressures the need for good governance. AGI is currently being provided by big platform companies such as Microsoft, OpenAI, and Google. Therefore, more questions are being constituted regarding vendor independence, privacy, and accessibility of education. But with the use of LLMs other ethical questions occur such as copyright laws, working conditions, and the environment. Therefore, good AI governance in higher education is growing more and more urgent.

In conclusion, there is work to be done within the education sector to create good governance for AI within educational software. This thesis has shown that there is not enough guidance to help create good governance for AI in educational software. The first step is to develop the guidelines according to the value propositions of individual organisations. In addition to this, it is important to test to what extent the guidelines are effective and efficient. Thereby, the effects of governance instruments have not yet been proven. Further research must be done to investigate the impact of governance instruments on the formulation and implementation of governance practices. Lastly, practices of good governance can be optimized by looking at past errors and mistakes and keeping best practices in mind. Especially for the translation from principle to practice, where more research can be done to further bridge the gap between principle and practice.

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8 Appendix A

Appendix A

Educational software applications that use AI technologies.

Title	Description	Link	Category EC document	SubCategory EC document	Provider
Feedbackfruits	FeedbackFruits offers a complete tool suite to organize interactive and collaborative learning activities. Allowing you to implement blended and online learning more effectively.	https://feedbackfruits.com/	Student Supporting	AI-supported collaborative learning, Formative Writing Assessment	Commercial
AutoTutor	AutoTutor uses strategies of human tutors such as comprehension strategies, meta-cognitive strategies, self-regulated learning and meta-comprehension. In addition, AutoTutor incorporates learning strategies derived from learning research such as Socratic tutoring, scaffolding-fading, and frontier learning. (Alkhatlan and Kalita, 2018, pg. 16)	https://arxiv.org/abs/1812.09628 https://files.eric.ed.gov/fulltext/ED586834.pdf	Student Teaching	Intelligent Tutoring System	Non-profit
CIRCSIM-Tutor Project	The CIRCSIM-Tutor project was a language-based intelligent tutoring system for first-year medical students to learn about the reflex control of blood pressure. Students solve small problems and are tutored by Socratic dialogue with the computer. (link)	http://www.cs.iit.edu/~circsim/	Student Teaching	Intelligent Tutoring System	Non-profit
LeerLevels	At the moment, LeerLevels contains over 550 videos and infographics that cover the physics high school curriculum in The Netherlands. The next step is adding content for other STEM courses. Our modular approach enables a perfect integration between disciplines, allowing interdisciplinary projects to focus on our societal challenges.	https://www.leerlevels.nl/docent	Student Teaching	Intelligent Tutoring System	Commercial
Jill Watson Q&A	A virtual teaching assistant for answering questions based on educational documents including VERA's user reference guide	https://dilab.gatech.edu/a-suite-of-online-learning-tools/	Teacher Supporting	AI Teaching Assistant	Non-profit
StuA	StuA can help newcomers in a college who are hesitant to interact with the seniors as they fear being ragged. StuA is capable of answering all types of queries of a newcomer related to academics, examinations, library, hostel and extracurricular activities.		System Supporting	Guidance Services	Non-profit
VERA	A virtual experimentation research assistant for supporting inquiry-based learning of scientific knowledge. Currently, the AI focuses exclusively on Epidemiology and Ecology assistance.	https://dilab.gatech.edu/vera/	Teacher Supporting	AI Teaching Assistant	Non-profit
Jill Watson SA	A virtual social agent that promotes online interactions	http://dilab.gatech.edu/a-suite-of-online-learning-tools/	Student Supporting	AI-supported collaborative learning	Non-profit
Agent Smith	An Assistant that helps generate a Jill Watson Q&A agent for new documents such as class syllabi.	http://gvu.gatech.edu/research/projects/tool-building-interactive-agents-agent-smith	Teacher Supporting	AI Teaching Assistant	Non-profit

Alta	A complete course solution, Alta is designed to optimize the way students study and learn while completing assignments. All of Alta's content — including instructional text and video, examples and assessments — is organized by learning objective and served up at the precise moment a student needs it.	https://www.knewton.com/why-alta/	Student Teaching	Intelligent Tutoring System	Commercial
Bazaar: A Flexible Architecture for Collaboration Support	Bazaar has often been used to implement supportive interventions involving conversational chat agents that participate as facilitators in collaborative learning tasks.	http://ankara.lti.cs.cmu.edu/bazaar/	Student Teaching	Dialogue-Based Tutoring Systems	Non-profit
Lärka	Intelligent Computer-Assisted Language Learning – has as its main aim to draw on the opportunities offered by language resources, such as corpora, lexicons and natural language processing components including lemmatizers, parsers, etc., to build more sophisticated and flexible applications for language learners and students of grammatical theory.	https://spraakbanken.gu.se/larka/archive/#mode=selfstudy&group=linguists&exe=pos1&lang=sv&pos=KN,SN,DT,PP,PN,JJ,AB,NN,VB,PC,RG	Student Teaching	Language Learning Applications	Non-profit
Alphary	Alphary set an ambitious goal to redefine the English language learning experience and accelerate language acquisition by automatically providing learners with feedback and increasing user engagement with a gamification strategy.	https://www.alphary.net/#/home	Student Teaching	Language Learning Applications	Commercial
Goal Net	Using a combination of micro-MOOCs and learning path construction tools (possibly derived from Goal Net or other similar tools such as the Belief-Desire-Intention (BDI) model), instructors can specify a general syllabus consisting of finely grained learning contents and activities with improved efficiency and flexibility of updating. In courses in which the dependency among topics is not strong, the learning path construction tool could be open for MOOC learners to use to personalize individuals' learning paths.		Teacher Supporting	Pedagogical Resource Recommendation	Commercial
X5GON	The recommendation engine is designed to increase content engagement, quality assurance, audience engagement and footfall, directly improving site metrics. X5LEARN's core product is an AI engine connecting millions of pieces of OER content from different sites, cultures and in different languages in one interface based on relevance and personal learning needs.	https://x5learn.org/about	Teacher Supporting	Pedagogical Resource Recommendation	Non-profit
iStart	Interactive Strategy Training for Active Reading and Thinking (iSTART) is a Web-based application that provides young adolescent to college-age students with high-level reading strategy training to improve comprehension of science texts. iSTART is modelled after an effective, human-delivered intervention called self-explanation reading training (SERT), which trains readers to use active reading strategies to self-explain difficult texts more effectively.	http://www.adaptiveliteracy.com/istart#	Student Supporting	Formative Writing Assessment	Commercial

DC Circuit Construction Kit / PHeT simulations	PhET provides fun, free, interactive, research-based science and mathematics simulations. We extensively test and evaluate each simulation to ensure educational effectiveness. These tests include student interviews and observation of simulation use in classrooms. The simulations are written in Java, Flash or HTML5, and can be run online or downloaded to your computer. All simulations are open source.	https://phet.colorado.edu/en/simulations/filter?type=html&sort=alpha&view=grid	Student Supporting	Exploratory Learning Environments	Non-profit
Taylor	The Open University uses Taylor, an AI-based digital assistant, to improve the student experience for disabled learners... takes the student through topics such as their disabilities, study materials, and access to tutorials. Taylor can use natural language processing to 'understand' what the student has said, for example when identifying which recognised categories their disabilities fit with. This can then lead to appropriate responses, allow the student to use their terms and result in more useful data being captured from the conversation."	https://nationalcentreforai.jiscinvolve.org/wp/2021/09/27/how-digital-assistants-are-promoting-enhanced-accessibility-at-the-open-university/	Student Teaching	Dialogue-Based Tutoring Systems	Non-profit
Braille AI Tutor	Braille AI Tutor is one of the technologies in the ObjectiveEd suite. It lets a student improve their braille literacy using a braille display and speech recognition.	https://www.objectiveed.com/braille-ai-tutor	Student Teaching	Language Learning Applications	Commercial
Century Tech	The artificial intelligence engine creates personalised learning pathways that plug gaps in knowledge and remedy misconceptions. Easy-to-use data dashboards aid teacher-led interventions. Students who need additional support or challenges are quickly identified. Teachers are provided with thousands of high-quality resources for use in a variety of learning models including homework, classwork or revision.	https://www.century.tech/	Teacher Supporting	Pedagogical Resource Recommendation	Commercial
Write & Improve	Write & Improve uses new technology developed at the University of Cambridge to mark English writing accurately, in seconds. Submit your work and Write & Improve will score it on the CEFR (Common European Framework of Reference) scale, giving it a level from A1 (lowest) to C2 (highest). Write & Improve also shows you the parts of your text that may need improvement. So you can work more on these areas and keep improving.	https://writeandimprove.com/	Student Supporting	Formative Writing Assessment	Non-profit
Criterion	The Criterion® Online Writing Evaluation Service is a web-based instructor-led automated writing tool that helps students plan, write and revise their essays. It gives them immediate diagnostic feedback and more opportunities to practice writing at their own pace. The Criterion service frees up valuable class time and helps improve student outcomes by giving instructors and administrators a solution that concentrates on higher-level writing skills and areas of improvement. It is used both by teachers in the classroom, as well as by those teaching remotely as an online distance learning tool.	https://www.ets.org/criterion	Student Supporting	Formative Writing Assessment	Commercial

Ginger	The Ginger Essay Checker helps you write better papers instantly. Upload as much text as you want – even entire documents – and Essay Checker will automatically correct any spelling mistakes, grammar mistakes, and misused words. Ginger Essay Checker uses patent-pending technology to fix essays, improving your writing just like a human editor would. Take advantage of the most advanced essay corrector on the market. You'll benefit from instant proofreading, plus you'll automatically improve your writing skills as you view highlighted errors side by side with Ginger Essay Checker's corrections.	https://www.gingersoftware.com/essay-checker	Student Supporting	Formative Writing Assessment	Commercial
Grammerly	Grammarly is a Ukrainian-origin American-headquartered cross-platform cloud-based writing assistant that reviews spelling, grammar, punctuation, clarity, engagement, and delivery mistakes. It uses AI to identify and search for an appropriate replacement for the mistake it locates. (Wikipedia) -- Grammarly can sometimes automatically detect potential grammar, spelling, punctuation, word choice, tone and style mistakes in writing, following standard linguistic prescription, although it may make mistakes. Algorithms flag potential issues in the text and suggest context-specific corrections for grammar, spelling, wordiness, style, punctuation, and plagiarism, although some are only for premium users.	https://www.grammarly.com/	Student Supporting	Formative Writing Assessment	Commercial
Mi Write / Mi Tutor	MI Write is a web-based learning environment and formative assessment system that allows students to improve their writing through frequent practice and guided instructional support. Available anywhere, on any device, MI Write combines more opportunities to write with immediate scoring and feedback to help students develop effective writing skills. Student writing is instantly evaluated by MI's award-winning automated scoring technology, 24 hours a day, 7 days a week. By streamlining the grading process, MI Write makes it easier for teachers to focus more on developing learning strategies and interacting with students.	https://www.measurementinc.com/products-services/automated-essay-scoring	Student Supporting	Formative Writing Assessment	Commercial
MY Access! - Virtual Writing	MY Access! is an online writing instruction and assessment program, and teaching tool that improves student writing proficiency and motivates students to write more frequently by providing immediate scores and continual, adaptive, prescriptive feedback and edit suggestions.	https://www.vantagelearning.com/products/my-access-school-edition/	Student Supporting	Formative Writing Assessment	Commercial
TurnitIn	Turnitin solutions promote academic integrity, streamline grading and feedback, deter plagiarism, and improve student outcomes.	https://www.turnitin.com/	Student Supporting	Formative Writing Assessment	Commercial
Writing Mentor	The Writing Mentor application offers two writing modes. In Paragraph Writing Practice, get more comfortable writing by working with "Sam", using Writing Help, proofreading, and earning badges! In Extended Writing, review the feedback. Feedback is not only about correcting errors! The feedback is intended to help you to reflect on, and revise your writing to make it well-developed, coherent, well-edited, and more convincing!	https://mentormywriting.org/	Student Supporting	Formative Writing Assessment	Commercial

Writing Pal	Writing Pal, a web-based software tool was developed to provide a means of automatically scoring essays in the same way as a teacher might while also providing writing strategy instruction, game-based practice and individualized formative feedback to help students improve their writing proficiency. This system is not intended as a replacement for classroom instruction or homework, but rather as a supplemental writing practice.	http://www.adaptiveliteracy.com/writing-pal	Student Supporting	Formative Writing Assessment	OpenSource
Merlyn Mind	Merlyn lets teachers do with their voice or remote what previously took many steps and led to wasted time and frustration. Merlyn is natural to use by design and integrates with the apps and devices teachers already use.	https://www.merlyn.org/product	Teacher Supporting	AI Teaching Assistant	Commercial
WRTS	WRTS is an online learning platform that helps you learn words and concepts faster and easier. You can use WRTS anytime, anywhere. Quickly find the right lists from your textbooks and practice the words with the different practice and quiz options.	https://wrts.nl	Student Teaching	Language Learning Applications, Intelligent Tutoring systems	Commercial
Genie	Deakin Genie App is a part of Deakin's digital frontier for excellence in education. It allows students to easily access their timetable, results, and unit information as well as an array of answers to common student questions.	https://www.deakin.edu.au/about-deakin/news-and-media-releases/articles/deakins-genie-a-virtual-digital-assistant-out-of-the-bottle	System Supporting	Educational Data Mining for Resource Allocation, Guidance Services	Non-profit
Yuja	Yuja allows users to create audio/video content on their computer and upload it to the Yuja online storage and streaming environment. In addition, the software automatically captions any/all content created. YuJa Panorama automatically improves the accessibility of digital media and course content. Panorama brings market-leading Artificial Intelligence and Machine Learning capabilities into the digital accessibility process.	https://www.yuja.com	Teacher Supporting	*AI Teaching Assistant*	Commercial
Photo Math	Photomath is a mobile application that utilizes a smartphone's camera to scan and recognize mathematical equations; the app then displays step-by-step explanations onscreen. It is available for free on both Android and iOS.	https://photomath.com/en/	Student Teaching	Intelligent Tutoring System	Commercial
Examus	Examus Inc. has developed an advanced AI proctoring solution that prevents cheating attempts during online exams as well as monitors and controls students' behaviour during the process. Examus enables universities to get verified results from online exams. Examus enables students to study and take exams remotely from anywhere in the world. The main aim of Examus is to improve the educational process and make it easy and affordable for every to study remotely and receive verified trusted results. Examus AI proctoring solution can be integrated into any learning management system (LMS) or testing platform.	https://examus.net	Teacher Supporting	Student Forum Monitoring, Pedagogical Resource Recommendation	Commercial

Alelo	Using cloud-based AI simulations, learners engage in interactive conversations with socially intelligent virtual humans in a realistic setting. They role-play with avatars as often as they like on a mobile device, desktop, or virtual reality headset. Immediate feedback provides personal instruction on how to improve. When encountering a real-world situation, learners are confident and adept. Role-playing with Artificial Intelligence (AI) avatars is a breakthrough way for students to practice conversational Spanish, English and HR skills.	https://www.alelo.com	Student Teaching	Language Learning Applications, Dialogue-based Tutoring Systems	Commercial
IguideMe	IguideME (I Guide My Education), is a dashboard that was developed at the Faculty of Science (UvA) and is used to provide personalized feedback to (a large group of) students and teachers. The goal of this project is to activate, motivate and provide personal feedback to students during the entire learning process using a specific blended learning method in combination with the application "IGuideME" where information about the learning process is conveniently gathered in one central digital location.	https://communities-surf-nl.translate.goog/artikel/de-eerste-ervaringen-met-iguideme-gepresenteerd-op-de-surf-onderwijsdagen-2021-1?_x_tr_sl=nl&_x_tr_tl=en&_x_tr_hl=en&_x_tr_pto=sc	Student Supporting	Formative Writing Assessment	OpenSource
Comproved	Comproved helps teachers, educators and assessors to assess better. We do this with knowledge and tooling. Years of scientific research have shown that comparative assessment works because people naturally make comparisons. Our comparing tool structures these comparisons and forms a valid, reliable and user-friendly instrument. The tool is perfect for large and small assessments and provides data that teachers and students learn from.	https://comproved.com/	Student Supporting	Formative Writing Assessment	Commercial
Scholarcy	Scholarcy, the online article summarizer tool, reads your research articles, reports and book chapters in seconds and breaks them down into bite-sized sections – so you can quickly assess how important any document is to your work.	https://www.scholarcy.com/	Student Supporting	Formative Writing Assessment	Commercial
Deepl	DeepL's neural networks can capture even the slightest nuances and reproduce them in translation, unlike any other service. In blind tests pitting DeepL Translator against the competition, translators prefer DeepL's results by a factor of 3:1. DeepL also achieves record-breaking performance according to scientific benchmarks. Also has access to CAT tool integration. DeepL is a German company that has set itself the goal of eliminating language barriers worldwide through the use of artificial intelligence.	https://www.deepl.com/translator	Student Supporting	Formative Writing Assessment	Commercial
Squirrel AI Learning	Squirrel Ai Learning is the first domestic adaptive learning engine based on an advanced algorithm and with completely independent intellectual property developed by YiXue Education. Squirrel is the symbol of "agility, diligence and management." This aligns with the experience Squirrel Ai Learning provides for its students, to help them advance learning through the real-time adaptive system and cultivate good learning habits with practice.	http://squirrelai.com/about	Student Teaching	Intelligent Tutoring System	Commercial

ALEKS	ALEKS is an artificially intelligent learning and assessment system that has been used by over 25 million students for Math, Chemistry, Statistics and Accounting. After quickly and accurately determining each student's precise knowledge of a subject, ALEKS helps the student work on the topics they are ready to learn. ALEKS intelligence, content and software are unique and proprietary; they have been developed together, and work in unison. ALEKS digital content provides comprehensive course coverage.	https://www.aleks.com/about_aleks	Student Teaching	Intelligent Tutoring System	Commercial
Perusall	Perusal aims to change the nature of reading — from the traditional solitary experience to an engaging and collective one. We aim to change education — so all students do the reading, come to class prepared, and are motivated to do so because they care about the content. We aim to advance behavioural science and AI research in the service of improving education — using our work at Harvard University and Perusall Labs to improve the Perusall platform and to help students, educators, researchers, and society at large.	https://perusall.com/about	Student Supporting	Exploratory Learning Environments	Commercial
MATHai	Students stay engaged with MATHia's personalized just-in-time feedback and contextual hints. MATHia uses sophisticated AI technology to adapt at a very detailed, skill-by-skill level.	https://www.carnegielearning.com/solutions/math/mathia/	Student Teaching	Intelligent Tutoring System	Commercial
Ada Bolton College chatbot	Ada is a chatbot at Bolton College that helps deliver personalized learning and assessment for students and queries about attendance or curriculum content.	https://www.boltoncollege.ac.uk/latest-news/praise-for-ada-bolton-colleges-chatbot/	Student Teaching, Student Supporting	Intelligent Tutoring System, Exploratory Learning Environments	*Non-profit*
Thinkster Math	Math tutoring program leverages human interaction and groundbreaking artificial intelligence to create personalized learning programs	https://hellothinkster.com/online-math-tutor.html	Student Teaching	Intelligent Tutoring System	Commercial
Brainly	A social media site for classroom questions	https://brainly.com/	Student Supporting	AI-Supported Collaborative Learning	Commercial
Nuance	Speech recognition software used by students and faculty; capable of transcribing up to 160 words per minute.	https://www.nuance.com/dragon/industry/education-solutions.html	Student Supporting	Formative Writing Assessment	Commercial
Cognii	AI-based products for education. Offers learning platform, virtual learning assistant, assessment platform, analytics platform, integration options, authoring	https://www.cognii.com/about	Student Teaching, Teacher Supporting	Intelligent Tutoring System, Pedagogical Resource Recommendation	Commercial
Gradescope	Gradescope helps teachers administer and grade all assessments, whether online or in class. Save time grading and get a clear picture of how your students are doing.	https://www.gradescope.com/	Teacher Supporting	Summative Writing Assessment, Essay Scoring	Commercial
Ivy Chatbot	Ivy is a set of chatbot AI tools that were specifically designed for universities and colleges. They assist in many parts of the university process, such as application forms, enrollment, tuition costs, deadlines, and more. Another unique feature of Ivy is its ability to plan recruitment campaigns through gathered data.	https://ivy.ai/	Student Teaching	Dialogue-Based Tutoring Systems	Commercial

Knowji	Audio-visual vocabulary application that leverages current educational research. Knowji is designed for language learners, and it uses various methods and concepts to help students learn faster.	https://www.knowji.com/	Student Teaching	Language Learning Applications	Commercial
Queirum	AI platform that helps students master critical STEM skills while preparing them for college and careers. The platform relies on personalized lessons and step-by-step tutoring assistance.	https://www.querium.com/	Student Teaching	Intelligent Tutoring System	*Commercial*
Knewton's Alta	Alta is Knewton's fully integrated, adaptive learning courseware. A complete course solution, Alta is designed to optimize the way students study and learn while completing assignments. All of Alta's content — including instructional text and video, examples and assessments — is organized by learning objective and served up at the precise moment a student needs it	https://www.knewton.com/	Student Teaching	Intelligent Tutoring System	Commercial
ASReview	ASReview uses state-of-the-art active learning techniques to solve one of the most interesting challenges in screening large amounts of texts. ASReview helps scholars and practitioners get an overview of the most relevant records for their work as efficiently as possible while being transparent in the process.	https://asreview.nl/	Student Supporting	Formative Writing Assessment	Non-profit
OpenEssayist: an automated feedback tool	Open University UK created OpenEssayist to provide feedback to students when preparing for an essay. It is a real-time analytics tool which operates through the combination of a linguistic analysis engine that processes the text in the essay, and a web application that uses the output of the linguistic analysis engine to generate the feedback.	https://oro.open.ac.uk/42041/	Student Supporting	Formative Writing Assessment	Non-profit
RoboTutor	RoboTutor is a scalable open-source tablet app that teaches basic literacy and numeracy with the use of machine learning, voice recognition and data-driven algorithms to personalise learning at a large scale.	https://www.cmu.edu/scs/robotutor/what-is-robotutor/index.html	Student Teaching	Intelligent Tutoring System	Non-profit
Geekie	Geekie is an adaptive learning platform from Brazil. Through machine learning, the software provides more personalised content as the student uses it more often.	https://www.geekie.com.br/	Student Teaching	Intelligent Tutoring System	Commercial
Daptio	Daptio is a personalized learning tool for teachers, students and content creators in Africa that uses deep analytics. It uses artificial intelligence to help students, mentors, and teachers understand the proficiency level of each student and then match the relevant content.	https://borgenproject.org/tag/daptio/	Teacher Supporting	Pedagogical Resource Recommendation	Commercial
Edaptio	Edaptio is a digital classroom helper for teachers. It helps create and develop interactive presentations, assessments, and content, and track students' progress - all-in-one platform	https://edaptio.com/	Teacher Supporting	AI Teaching Assistants, Pedagogical Resource Recommendation	Commercial
Quizlet	Quizlet is a digital learning platform that students can use to make custom sets of flashcards and diagram decks, which they can then review as study guides or in a variety of ways. Flashcards can also be converted into practice tests, allowing students to reinforce their knowledge through repetition.	https://quizlet.com/nl	Student Teaching	Intelligent Tutoring System	Commercial

Duolingo	Duolingo is a language learning app that teaches up to 40 languages in a game-like style. The app combines AI, machine learning, and language science to tailor lessons to each user and create a more personalized language learning experience.	https://www.duolingo.com/	Student Teaching	Language Learning Applications	Commercial
Pure Elsevier	Pure brings information from all your data sources onto a single, intelligent and secure platform, unlocking organized insights to elevate your research potential. It is a fully interconnected data model that empowers researchers to gain a comprehensive overview of all their research activities.	https://www.elsevier.com/solutions/pure	Teacher Supporting	Pedagogical Resource Recommendation	Commercial
Scribbr	Scribbr helps students write their thesis by helping with generating citations, checking for plagiarism, checking grammar and help with summarizing texts.	https://www.scribbr.nl/	Student Supporting	Formative Writing Assessment	Commercial

9 Appendix B

Appendix B

Applications that SURF procures for higher educational institutions that use AI technologies.

Title	Description	Link	Category EC document	Provider
Gradework	internship and graduation assistance	https://www.xebic.com/nl/oplossingen/gradework	student supporting	Xebic B.V.
Onstage	internship and graduation assistance	https://www.xebic.com/nl/oplossingen/onstage	student supporting	Xebic B.V.
Scorion	e-portofolio / programmatic testing	https://parantion.com/organisatie/scorion-talent/	student supporting	Paration B.V.
Proctorio	proctoring software	https://proctorio.com/	Teacher supporting	Proctorio GmbH
Proctor Exam	proctoring software	https://proctorexam.com/	Teacher supporting	Proctor Exam
Integrity Advocate	proctoring software	https://www.integrityadvocate.com/	Teacher supporting	D2L Corportation
FeedbackFruits	Feedback software	https://feedbackfruits.com/	student supporting	Commercial
Xerte Online Toolkits	Xerte is an award-winning suite of browser-based tools that allow anyone with a web browser to create interactive learning materials quickly and easily.	https://xerte.org.uk/index.php/en/	Teacher Supporting	DLearning B.V.
Snagit	Snagit is a screen recorder that can automatically recognize elements in your screenshot, granting the ability to rearrange or remove UI elements.	https://www.techsmith.com/screen-capture.html	Teacher supporting/student supporting	CD&E Distribution Europe
Camtasia	Camtasia is a screen recorder that can automatically recognize elements in your screenshot, granting the ability to rearrange or remove UI elements. Focuses on education by making it easier to upload a presentation and capture a camera, screen or microphone	https://www.techsmith.com/video-editor.html	Teacher supporting/student supporting	CD&E Distribution Europe
Document Workflow Management	Platform for document and contract management	https://nl.docfield.com/	system supporting	Docflow B.V.
Sensus BPM Online	Sensus BPM Online lets you map, improve and share all the processes in your organisation.	https://sensus-processmanagement.com/?lang=en	system supporting	Sensus process management
Easion Edu	application to create surveys and they collect respondents for data collection	https://easion.nl/	Teacher supporting/student supporting	Paration B.V.
qDNA	Dashboard application for feedback from patients	https://www.qdna.nl/en/home-en/	x	Entelligence B.V.
Ouriginal	Plagiarism Control	https://www.ouriginal.com/	Teacher supporting	Aquired by Turnitin
Turnitin	Plagiarism Control	https://www.turnitin.com/regions/uk	Teacher supporting	Aquired by Turnitin
Unicheck	Plagiarism Control	https://unicheck.com/	Teacher supporting	Aquired by Turnitin
Shakespeak	Digital learning tool real-time during class with live polls, quizzes etc. With the help of an AI content creator	https://www.sendsteps.com/nl/oplossingen/onderwijs/	Teacher supporting	Sendsteps
Euroglot	Offline translator that helps automatically translate texts with neural networks	https://euroglot.nl/	student supporting	Linguistic Systems
Articulate	Application to easily create e-learning environments	https://www.courseware.nl/producten/articulate/articulate-360/	Teacher supporting	Courseware
UbiOps	application to create AI models	https://ubiops.com/		Dutch Analytics B.V.
Zoom	Online meeting platform	https://www.duppal.com/solutions/meeting-solutions/zoom-meetings/	system supporting	Duppal
Microsoft	Platform software, such as Teams, Word, Excel, Powerpoint, Azure etc.	https://www.microsoft.com/nl-nl/microsoft-365/business/	system supporting	Microsoft

10 Appendix C

Appendix C

Governance documents that SURF provides for its members.

Governance Document	Date	Made by	What values are being maintained	Explanation	What actions are recommended	What problem does it aim to solve (regarding the AI problems)	Website link
Value Compass	2021	SURF & Kennisnet	Public values: humanity, autonomy, justice	This is a compass that supports dialogue on public values in the digitalisation of education. It was created together with Kennisnet. The value compass puts three main values for education at its centre: autonomy, justice, and humanity	The value compass provides an accessible manner to talk about public values regarding the digital transition and IT systems. It recommends discussing values	scaling up poor pedagogical ideas, possessing resources, Organisation of institutions, cultural diversity	https://www.surf.nl/over-surf/waardenwijzer-ondersteunt-gesprek-over-publieke-waarden-bij-digitalisering
Privacy and Ethics Reference Framework	2021	Versnellingsplan onderwijsinnovatie met ICT (collab of universities of the Netherlands, VH, and SURF)	Privacy	This framework helps institutions to carefully handle the education data that they accumulate. It states four ethical principles that institutions should take into account when using education data responsibly. Besides that, they also propose four legal principles that institutions should take into account. The document mainly focuses on the organisational structure of institutions and advises how it should be organised and who should be responsible for the different parts of handling education data.	The framework recommends how to internally organise an organisation, it helps to see who should be accountable for what regarding education data.	Possess resources, privacy literacy, data ownership, organisation of institutions	https://doe-meer-met-studiedata.nl/article/download-referentiekader-privacy-en-ethiek-voor-studiedata/
SURF Audit; toestingskader	2021, in 2023 no longer available and phased out	SURF	Privacy	This audit focuses on information security and the privacy of an educational institution. This audit helps institutions perform an information security or privacy assessment at any time, either for the entire organisation or for divisions. It should give them a clear idea of how well the institution has information security and privacy under control and where the priorities are for improvement.	The document states the requirements and the risk and then looks at the maturity of the institution on that requirement.	Transparency, privacy literacy, possess resources (knowledge)	https://www.surf.nl/surfaudit-inzicht-en-overzicht-in-je-informatiebeveiliging-en-privacy

SURF Audit; normenkader	2017	SURF	Privacy	This norms framework states the norm that must be complied with when performing information security	the document gives a norm, a control a baseline on how important the norm is, and an explanation. For example, a set of policies for information security should be defined, and approved by management. All information security responsibilities should be defined and allocated. Privacy and protection of personally identifiable information should be ensured as required in relevant legislation and regulation where applicable	Privacy literacy, data ownership, transparency	https://www.surf.nl/surfaudit-inzicht-en-overzicht-in-je-informatiebeveiliging-en-privacy
Learning Analytics under the Dutch Data Protection Act	2017	SURFnet	Privacy	This document focuses on how members of SURF can comply with the GDPR act when it went into service in 2018. The document focuses on what personal data is when you are permitted to process personal data, what preconditions apply, what obligations you must apply to and how to deal with third-party services.	The document helps with questions regarding GDPR compliance. It provides an 11-step plan: 1. Determine the purpose for which you wish to use learning analytics and what is required to realise these purposes. 2. In a separate privacy statement, record the purposes of the learning analytics, what data you will be collecting and what will be done with this data. 3. Whenever possible, aggregate the data, into combined information no longer showing any specific details of individuals. The aggregation must be irreversible. You should therefore destroy or protect the source data following aggregation 4. Substantiate which principles the institution wishes to use and why the use of learning analytics must reasonably be deemed essential. If you wish to work with permissions, ensure that: a. the students have access to clear explanations before granting permission; b. the students can refuse permission at that moment without any consequences to them; c. the students can determine from the request for permission exactly what it is they are consenting to; d. the students can respond to the request for permission by explicitly granting or declining permission (yes or no). 5. Agree with the provider that the provider will give detailed explanations for you to include in the privacy statement. This is also required for updates to the tool. 6. Monitor the use of learning analytics data, in any event, if it is being used for purposes other than the original purpose. If the data is accessible, then you run the risk of it being used for new purposes. 7. Ensure that students can easily download and correct learning analytics data. 8. Investigate which learning analytics tools make automatic decisions that can affect students to a significant degree, and always offer clear opportunities to object to these decisions. 9. Conclude processor's agreements with the providers of online learning analytics tools. 10. Establish a policy to prevent data leaks and security breaches. 11. React positively to students' privacy concerns and objections and ensure that you offer alternatives that can resolve these concerns.	Privacy literacy, AVG, education surveillance	https://www.surf.nl/files/2020-03/learning-analytics-under-the-dutch-data-protection-act.pdf

SURFnet Data Sharing Policy	2016	SURFnet	Privacy	Legal and ethical guidelines relating to sharing for research purposes	The policy document shares what actions SURFnet themselves take to act as a role model. 1. The use of operational data must not hinder or influence normal operations. 3. data must be processed according to the GDPR principles. 4. SURFnet can make certain data available for use in research. 5. the conditions to which research is subject get assigned a privacy risk level (low, medium, high risk) with high risk requiring a mandatory ethical review. 6. The risk level is approved by SURFnet's privacy officer. 7. Researchers requesting data from SURF will be asked to provide an assessment of the ethical implications of their research. 8. medium and high-risk data will be destroyed or returned to SURF unless agreed otherwise. 9. The researcher can not disclose data to any third party, nor use the data for any purpose other than the research purpose defined. 10. the research institution is responsible for the internal management of low and medium-risk data immediately after the transfer of the data.	Data ownership, privacy literacy	https://www.surf.nl/files/2019-03/surfnet-data-sharing-policy-1.0.pdf
Ethical guidelines on the use of AI and data in teaching and learning for educators	2022	European Commission, Directorate-General for Education, Youth, Sport and Culture; here some SURF employees contributed	Human agency and oversight, Fairness, Humanity, Justified choice, transparency, diversity, non-discrimination, societal and environmental well-being, privacy and data governance, accountability, technical robustness and safety, privacy and data governance.	This report investigates AI in education. It explains AI to teachers and educators. The document creates different categories for different AI systems used in education. It also poses critical questions that teachers can ask to see if the AI system is ethical to use	For each requirement, the guidelines give questions that educators can ask. For example, For transparency: Are teachers and school leaders aware of the AI methods and features being utilised by the system? Is it clear what aspects AI can take over and what not within the system? Next, it gives examples of situations and how the questions can be asked. Then, the document advises on planning and effective use of AI and data in school. For example, how to collaborate with the AI system provider, and how to carry out a pilot of the AI system. Lastly, the document mentions emerging competencies for the Ethical use of AI and data. Here a competence element is mentioned and potential indicators are given. For example, justified choice: Knows that AI and data use may benefit some learners more than others.	privacy literacy, technology that is developed outside the educational sphere, organisation of institutions, personalisation, AI systems intended for assessing students	https://op.europa.eu/en/publication-detail/-/publication/d81a0d54-5348-11ed-92ed-01aa75ed71a1/language-en
Toetsingskader voor doorgifte van persoonsgegevens	2023	SURF Taskforce Beyond Privacy Shield	Privacy, (GDPR compliancy)	The toetsingskader aims to give members of SURF insight into the risks that are connected to data transfers and give practical advice with which members of SURF can decide to transfer data and under what conditions	Firstly, the document investigates the transfer of data to third countries or international organisations. Then the document looks at different options on how to transfer data and what characterizes data transfering. Then it helps to make an incentivisation of what the applicable laws are and who the data importer is. Then it looks at the risks of a data transfer. Lastly, it advises on additional measures to take when data transferring.	Data ownership, privacy literacy	Still under the last reviews

Algoritme register	2023	SURF	Transparency, fairness	Start of a project to register algorithms used in higher education institutions	This project is ongoing, but there is not yet a register.	Possess resources, privacy literacy, data ownership	https://communities.surf.nl/ai-in-education/artikel/transparantie-van-algoritmen-in-het-onderwijs-waarom-we-er-niet-aan
Discussion paper: Ethisch gebruik van AI in het onderwijs	2021	SURF SIG AI	Humanity, freedom, justice, fairness, autonomy, accountability, prevention of harm	this document looks at the ethical use of AI in education and looks at what institutions can do the take the recent developments regarding AI into account	1. trying to apply guidelines to help support the process of transparency and decision-making about AI applications. 2. come to agreements with FG and CISO of institutions on a process for assessment of AI technologies that are being applied in education. 3. Cooperation with other knowledge institutions is preferable, to help share best practices.	The applicability of AI ethics guidelines, by looking at one and trying to apply it to different AI applications in education.	https://surfdrive.surf.nl/files/index.php/s/dI4GpZCRdgve17B
Promises of AI; Discussing the impact of AI systems in educational practices	2022	SURF	Not specifically mentioned, autonomy, privacy, fairness, security, transparency	Maatschappelijk Verantwoord Inkopen documents help IT managers to be conscious of the sustainability of the product that they are buying. The document helps to check the quality of the products or services, and the effects on the environment, humans, and society.	The document looks at AI applications in education at different levels (micro, meso, macro). At each level, it proposes questions for students, teachers, and staff to ask. For example, who can the students go to for help when they don't agree with an algorithm's evaluation of their work? What will the organisation do if a system gives an insensitive or offensive answer that may harm a student?	Possess resources, technology that is developed outside the educational sphere, transparency, platformization of education	https://www.surf.nl/files/2022-07/promises-of-ai-in-education-june-2022-def2.pdf
Automatische Spraakherkenning	2020	SURF	Autonomy, freedom	The report investigates how automatic voice recognition tools can be used for educational purposes. To do this, it explains how it works, and how you can build it yourself and how to use it	The document explains how speech recognition works and how institutions can use it. It advises what equipment to use for what and how to use it, it shows different language models and how to choose a model that suits the goal of the project. Then the report shows how to correct a model if it guesses incorrectly. Lastly, the document shows how to interpret the results of the model	Possess resources	https://www.surf.nl/files/2021-01/rapport-spraakherkenning-voor-open-leermaterialen_v1.0.pdf

Een open, toegankelijk en betrouwbaar internet; SURF position paper op het gebied van internet governance	2016	SURF	Privacy, accessibility, reliabilty, security	The paper explains the position of SURF on an open accessible and trustworthy internet. Besides that, it looks at what SURF is going to do and it explains the public debate	The document does not recommend actions but shows what actions SURF takes to position itself in the debate: 1. SURF works continuously on a reliable and safe internet by having a duty of care for its users. 2. Protect the public values against political and commercial influences. 3. take place in the public debate for its members with governments. 4. engaging in partnerships that will contribute to an open, accessible and reliable internet	googlization, possess resources	surf.nl/files/2019-02/position-paper-een-open-betrouwbaar-en-veilig-internet.pdf
Benut de kansen van digitale leermiddelen	2018	SURF	ownership of (education)data, accessibility	Recommendations on how to navigate digital learning resources	1. to efficiently use public resources and obtain insight into costs and financing streams. 2. have conditions for market parties about ownership and usage of user data of students. 3. invest in open learning resources. 4. investigate how the costs for students and facilities can be controlled and their security and privacy maintained.	Data ownership, Willingness to change, possess resources	https://www.surf.nl/files/2019-03/benut-de-kansen-van-digitale-leermiddelen.pdf
Op naar een EDUID voor alle studenten in Nederland	2018	SURF	Freedom, autonomy	information paper on how one digital ID for students can increase student mobility	No concrete actions but helping explore the possibilities and feasibility of an eduID. Stimulate debate	Learner agency, platformization of education, data ownership	https://www.surf.nl/files/2019-03/op-naar-een-eduid-voor-alle-studenten-in-nederland.pdf
Regie op de digitale transitie	2021	SURF	Autonomy, freedom, inclusion, safety, public values	This report presents the main focus points SURF thinks the elections from 2021 should take into account when working towards an inclusive digital society.	In the document, SURF positions itself in the elections of 2021. They want to invest in an excellent digital infrastructure, protect public values, strengthen the digital main port, push for inclusion and new technologies	Vendor lock-in, organisation of institutions	https://www.surf.nl/files/2020-09/inbreng-voor-surf-verkiezingen-2021.pdf
MVI-criteria werkplek en mobiele devices	2018	SURF	Sustainibility	Maatschappelijk Verantwoord Inkopen documents help IT managers to be conscious of the sustainability of the product that they are buying. The document helps to check the quality of the products or services, and the effects on the environment, humans and society.	The document takes a category and a level and gives criteria for that combination. For example, the applicant guarantees that the background lighting of LCD screens does not contain any mercury. The applicant guarantees that she makes a maximal effort to comply with human rights	public money spent on software	https://www.surf.nl/criteria-voor-maatschappelijk-verantwoord-inkopen-mvi-van-ict
MVI-criteria servers en datacenterfacilit eiten	2018	SURF	Sustainibility	Maatschappelijk Verantwoord Inkopen documents help IT managers to be conscious of the sustainability of the product that they are buying. The document helps to check the quality of the products or services, and the effects on the environment, humans and society.	The document takes a category and a level and gives criteria for that combination. For example, the application guarantees the delivery of products that fit the default interfaces. The data centre has a sustainable cooling installation.	public money spent on software	https://www.surf.nl/criteria-voor-maatschappelijk-verantwoord-inkopen-mvi-van-ict

MVI-criteria reproductieapparatuur	2018	SURF	Sustainibility	Maatschappelijk Verantwoord Inkopen documents help IT managers to be conscious of the sustainability of the product that they are buying. The document helps to check the quality of the products or services, and the effects on the environment, humans and society.	The document takes a category and a level and gives criteria for that combination. For example, explain what steps the applicant takes to limit the emission of greenhouse gasses during transport. Explain what steps the applicant takes to get to a closed-loop supply chain.	public money spent on software	https://www.surf.nl/criteria-voor-maatschappelijk-verantwoord-inkopen-mvi-van-ict
MVI-criteria cloud en applicatiediensten	2018	SURF	Sustainibility	Maatschappelijk Verantwoord Inkopen documents help IT managers to be conscious of the sustainability of the product that they are buying. The document helps to check the quality of the products or services, and the effects on the environment, humans and society.	The document takes a category and a level and gives criteria for that combination. For example, explain what steps the applicant takes to prevent overcapacity. The applicant guarantees that there is a max of x% overcapacity.	public money spent on software	https://www.surf.nl/criteria-voor-maatschappelijk-verantwoord-inkopen-mvi-van-ict
Grip op e-waste	2017	SURF	Sustainability	This document advises institutions on what part they can play in reducing e-waste. The document informs on this issue and advises on best practices	The document advises on the different parts: buying and usage, a discharge phase, and external market parties. It gives advice such as: using devices for as long as possible and trying bing on your device. Recycle used devices by using them again or passing them on to employees or studentsThe document provides a checklist for external parties.	*reducing e-waste, disposal of electrical devices, in education*	https://www.surf.nl/rapport-grip-op-e-waste
Whitepaper: Deep-learning enhancement of large-scale numerical simulations	2020	SURF	Freedom, autonomy	This paper aims to provide concrete guidelines to scientists and others who would like to explore opportunities for applying deep learning approaches in their large-scale simulations. Besides that, it also shares best practices.	The document recommends best practices and the overall approach and steps to be taken to train a deep learning model: analyse the original simulation, decide on strategy, map the scientific problem, understand your inputs, choose NN architecture, train NN, and validate NN predictions. It goes into more technical detail in the paper itself. Lastly, the paper shares specific cases where they used deep learning and how it was being used and made.	possess resources, and technology that are developed outside the educational sphere	https://www.surf.nl/whitepaper-deep-learning-enhancement-of-large-scale-numerical-simulations
Aandachtspunten voor een veilige en betrouwbare infrastructuur voor Learning Analytics en Studiedata	2021	SURF	Transparency, security, privacy, data quality	This document shares what to account for when developing an infrastructure for learning analytics when education data is analysed. The document provides critical questions that can help make responsible decisions regarding the use of education data.	Per category, this document asks the institutions a question to see how the infrastructure for learning analytics and education data is being set up. these are questions such as: Can personal data be anonymised if there is a request to do so? Is personal data only being processed in the EER? To what extent are the algorithms that are used, public?	Data ownership, possessing resources	https://www.surf.nl/files/2021-05/surf-aandachtspunten-voor-een-veilige-en-betrouwbare-infrastructuur-voor-learning-analytics-en-studiedata.pdf

Verkenning Regie op Studiedata door Studenten	2022	Dialogic in assignment from SURF	Autonomy, privacy, security,	This document examines the possibilities, conditions, and possible partnerships for an infrastructure for the management of education data	The document investigates what an infrastructure facilitates and how it should be built: there is a difference in the exchange of education data between MBO and HO so the infrastructure should facilitate this difference, the exchange should be clear such that students can understand and know what they agree to. They propose 4 scenarios for the management of education data: at the data source, at the educational institution, at a national level, or in a processing register. Next, it is assessed how an infrastructure should be built: and how each part can play a role in the entire process.	Education surveillance, technology that is developed outside the educational sphere, data ownership	https://www.surf.nl/files/2023-01/verkenning-regie-op-studiedata-door-studenten-december-202271.pdf
HOSA overkoepelende principes	2021	HOSA SURF	Humanity, Freedom, accessibility, sustainable, robust, secure, transparent	HOSA overkoepelende principes document shows the principles that the Higher Education Sector Architecture want to maintain and the consequences if they are being maintained	No concrete actions, but more what the sector generally can do: such as be compliant with GDPR, be active in being sustainable, positioning the relationship of humans to society regarding Artificial Intelligence	The agreement on what principles should be maintained	https://www.surf.nl/files/2021-11/hosa-overkoepelende-principes-v1.0.pdf
Privacy Bingo-kaart	2023	SURF	Privacy	The bingo-kaart is partly available for members but mostly used for internal SURF services. The bingo part follows a checklist to see what is relevant to maintain privacy in service, some activities occur always and some less, the bingo kaart is ordered from always to less often	The bingokaart advises speaking with the privacy officer, practising privacy by design, creating a privacy inventory, doing a DPIA (that SURF offers internally), conducting a privacy and cookie agreement, and a processing register.	Privacy literacy, data ownership, transparency	https://confluence.ia.surf.nl/display/KIJ/De+Privacy+Bingokaart
Whitepaper: Online Proctoring	2020	SURF	Privacy, security, academic integrity	The white paper discusses the implementation and possibilities of online proctoring, with value issues such as privacy, security, and academic integrity in mind. The paper concludes that online proctoring for specific situations has added value.	The document mentions foundations for processing personal information, shows who is responsible, has a human in the loop when there is automated decision-making, and uses a data protection impact assessment. Additionally, they advise on how a student can commit fraud. For example, to use screen captures or an extra webcam. They also provide a table to see how high the stakes are compared to how high the risks are to see when proctoring software can or should be used.	Privacy Literacy, education surveillance	https://www.surf.nl/files/2020-04/surf-rapport-online-proctoring_2020_update-april-2020.pdf
Blogposts on Communities website							

Hoe chatgpt jouw werk als docent makkelijker maakt	2023	SURF	AI literacy	Tips on how teachers can implement chatgpt in their work	Let chatGPT create your learning materials and lesson plans, create a rubic with ChatGPT, Let ChatGPT think of practice and knowledge questions, use ChatGPT to convert your sources to APA style, let ChatGPT give feedback on texts and formulas, create videos and images with AI, use ChatGPT to make summaries.	AI literacy, data literacy, privacy literacy	https://communities.surf.nl/vraagbaak-online-onderwijs/artikel/hoe-chatgpt-jouw-werk-als-docent-makkelijker-maakt
Artificial Intelligence in het onderwijs: wat is het en wat kun je ermee?	2021	SURF	AI literacy, transparency	This blog investigates what AI, how it can be applied in education, the relationship between the teacher and the AI, and what the challenges are to apply AI carefully	The blog gives examples of AI applications in education: real-time learning with writing assignments in FeedbackFruits, personalised learning with Leerlevels, preparing students for a future with AI, personally guiding students, automatic evaluations with machine learning, and optimising travel to and from educational institutions. Next, the blog mentions some remarks for teachers: think together with colleagues about the educational purposes and what data and AI applications can help with that, if you are using an AI application try to understand/immerse yourself in the black box, make sure to you know how the application makes the decision.	AI literacy, data literacy, privacy literacy	https://communities.surf.nl/ai-in-education/artikel/artificial-intelligence-in-het-onderwijs-wat-is-het-en-wat-kun-je-ermee
AI-generated text detectors: Do they work?	2023	SURF	Academic integrity	This blog tests different AI-generated text detectors to see how well they recognize AI-written tests. The blog encourages the reader to also experiment with this	At the conclusion the blog encourages the reader to experiment with generation detection tools, thereby the writer gives four clear steps: to experiment with prompts, to generate text for each prompt using AI, to feed the texts into the tool that you want to test and see how often it classifies the text as AI written texts.	Academic integrity, education surveillance, data ownership	https://communities.surf.nl/en/ai-in-education/article/ai-generated-text-detectors-do-they-work
Zo maak jij je LMS studentvriendelijk	2022	SURFcommunities -> VU onderwijs adviseur	Digital literacy	This blog provides tips on how to create a learning management system that is easy to use for students	the tips are to use fewer menu options, put all the information in one place, create a logical structure for your students, use a homepage for clarity and a warm welcome, and lastly publish on time.	Organisation of institutions, willingness to adapt & change	https://communities.surf.nl/digitale-leer-en-werkomgeving/artikel/zo-maak-jij-je-lms-studentvriendelijk
Hoe voorkom je een datalek bij jouw instelling?	2023	SURF	Privacy	This blog advises the reader on how to avoid a data leakage at an institution	the advantage of this blog is that: it limits access to data. For example, don't send personal data via email, keep data at a central place and give users access to that application. Prevent data leakage by privacy by design and contact the privacy officer during the development of new systems. Create privacy awareness, such that everyone knows what to do when a leakage occurs. Lastly, check if the information security is in order.	Data leakage	https://communities.surf.nl/cybersecurity/artikel/hoe-voorkom-je-een-datalek-bij-jouw-instelling

11 Appendix D

Appendix D

Potential ethical issues of AI in educational software applications and what values might be harmed.

Potential Ethical Issues of AI in Education	**Values that might be at stake**	**Explanation of ethical issues**	**Source**
Proctoring	Academic integrity, privacy, autonomy, fairness	Proctoring software films the student during an exam to keep an overview and to avoid cheating. However, here academic integrity, not cheating on tests and testing your knowledge, is at stake versus the privacy and autonomy of the student. The student must film themselves during a test when there could be other (personal) things in the background. Lastly, the software examining the recording from the student during an exam must be fair.	Coghlan et al. (2021); Nigam et al. (2021); Draaijer et al. (2018)
Vendor Independence	Autonomy, privacy	With vendor lock-in, the customer/institution is dependent on the supplier for products and services, because is almost impossible to change suppliers without any high costs or inconveniences. Vendor independence is when customers can easily change between suppliers.	Sjoerdstra, B. (2016)
Scaling up of poor pedagogical ideas --> AI made outside of education	Autonomy	AI systems can be made outside of the educational environment. This means that the systems were not originally meant to be used for education. Another issue could be that when AI systems with educational purposes are made outside of the educational environment or made by independent companies, they might push other pedagogical ideas upon institutions, that they might not necessarily agree with. Thus, could nudge students in a specific manner.	Bartoletti (2022)
unfair examination because the examination is automatic and contains bias	Transparency, fairness	Automatic feedback systems can be unfair. Resulting in an unfair examination of grades and receiving feedback. Therefore, the systems should be transparent in how the feedback is designed.	Borenstein and Howard (2020); Baker and Hawn (2021); Filgueiras (2023)

losing autonomy because of learning material that is automatically adapted.	Autonomy, privacy	Intelligent tutoring systems adapt the learning material to the skills and needs of the student. This has benefitted the students who can learn better. However, the autonomy of the student is at stake here. The students can no longer choose what is relevant and interesting for them. Besides that, the student could also influence the tutor in a way that would harm the learning path of the student by only focusing on one part of the questions.	Akyuz (2020); Latham (2022); Ashman et al. (2014); Wang et al. (2020)
datafication of the entire value chain	Autonomy, transparency, privacy	Pure Elsevier is an interconnected data model. It brings together research information from all your data sources. It should help to streamline the entire research lifecycle. However, researchers need to make sure their information is compatible with the system, they need time to keep it up to date etc.	Williamson et al. (2023)
Intelligent tutor systems	Humanity, autonomy, fairness, privacy	An intelligent tutor system (ITS) that can be used to simulate one-to-one personal tutoring). ITS uses advanced algorithms to provide customized learning techniques for various students according to their needs and capacities	Akyuz (2020); Ashman et al. (2014); Braunack-Mayer et al. (2020); Zawacki-Richter et al. (2019)
Issues mentioned in the literature			
Platformization of education	Gradual process of transforming practices for human development through teaching and learning, aiming to develop and enhance the intellectual capacity of individuals with the support of different digital tools	Issues: Privacy: surveillance processes and altered power dynamics, biases and injustices: when systems make autonomous decisions. Data governance: poorly structured of unreliable data usage while collecting more data can amplify privacy issues. digital literacy. cybersecurity issues:	Filgueiras, 2023; Williamson et al. (2023)
Googlization	Privatization, transparency, autonomy	Tech company penetration of the market for online educational services and hardware such as Chromebooks	Kerssens and Van Dijck (2021)
Interoperability of different AI systems used in education	Autonomy	Desired primacy of decentralized diverse and open ecosystems that strengthen the sovereignty of public schools requires a form of public governance that promotes interoperability across all levels of the platform ecosystem	Kerssens and Van Dijck (2021)

Personalization	Privacy, autonomy	The pathway might be personalised, but the destination must be fixed. Besides that, education is about collaborations and other social interaction aspects of teaching and learning, which might get less attention when everything is personalised	Holmes et al. (2022)
Profiling students	Equity, privacy, autonomy, fairness, non-discrimination	Helpful when examining which students are at risk of dropping out. But is intrusive and harms the student's privacy	Holmes et al. (2022)
AI systems intended for assessing students	Fairness, transparency, non-discrimination, on-maleficence	Many AIED tools often use computational learner modelling that uses profiles or stereotypes to predict academic performance and identify learners for early interventions. Which can lead to discrimination in underrepresented populations.	Holmes et al. (2022)
Cultural diversity	Fairness, transparency, non-discrimination, non-maleficence	Given the overwhelming balance of research carried out by the global north and challenges in the transfer of appropriate	Holmes et al. (2022)
Education surveillance	Privacy, autonomy, fairness	Monitor the student's participation and expressions and display this data on a dashboard for the teacher. The question is whether these systems provide real added value for a good teacher who should be able to capture the dynamics in a learning group and respond to this in an empathically and pedagogically meaningful way	Zawacki-Richter et al. (2019)
Data ethics and algorithmic biases	Fairness, transparency, non-discrimination, non-maleficence	AI is not biased. Instead, if its data are biased or analysed with inappropriate algorithms, the original perhaps unidentified bias can become more noticeable and have a greater impact	Miao et al. (2021)
Learner agency	Autonomy	Less time for learners to interact with each other, more decisions made by machines, and more focus on the type of knowledge that is easiest to automate.	Miao et al. (2021)
Potential Governance issues of AI in education			
Innovation quickly, policy slow	Public values	Technology innovations move quickly, while the policy that should keep the innovations in check and make sure human rights are not harmed often falls behind the fast innovation of technology.	AI employees SURF

Possess resources (knowledge, time, manpower) & possibility of being autonomous	AI literacy, data literacy, vendor lock-in	Institutions might not possess all the resources to build or use AI responsibly. There is time, knowledge and manpower needed to develop these systems. Besides that, remaining autonomous in decision-making on what algorithms to use and what data is used could be at stake here. Especially when multiple organisations together sign a contract for a service.	AI employees SURF
Willingness to adapt and change	AI literacy,	Institutions and educators need to be willing to adopt new AI technologies in their work. Besides, the technologies also need to be willing to adapt to be more ethical and trustworthy systems.	AI employees SURF
AVG & privacy causing difficulties in collecting data for training	Privacy	The GDPR can make it difficult for institutions to collect data for training. Institutions must comply with the GDPR rules but also want to train good algorithms.	AI employees SURF
Privacy Literacy	Privacy	Institutions, educators, and students must know about privacy, to know what is possible and what is not possible, when collecting or using data to train algorithms.	AI employees SURF
Technology that is developed outside the educational sphere	Public values, privacy, autonomy	Technology that is developed without educational purposes in mind, can cause unintended effects inside the educational institutions. For example, ChatGPT was not meant to be used for educational purposes.	AI employees SURF
Data ownership, who can do what with data?	Autonomy, privacy, transparency	A missing consensus on who owns the data and who can do what with data. This issue focuses mostly on access to data. There is data necessary to train new algorithms, without it. Besides that, it also focuses on interoperability. It is difficult to use data from one place in another one.	AI employees SURF
Organisation of institutions	Autonomy	The organisation of institutions also can be an issue. Since this could influence the autonomy when there is a difference of power within an institution. Lastly, the IT could be an external organisation which can also make it difficult to get access to or change the systems responsibly.	AI employees SURF
Transparency outside and inside an organisation	Transparency	Transparency inside an institution/organisation	AI employees SURF
The relationship between students and teachers is also dependent	Autonomy, fairness		AI employees SURF

Public money spent on software	Autonomy, public values	Educational institutions receive public money. With these educational resources are	Procurement SURF
The pragmatic situation is more towards the guidelines			AI employees SURF
Examples of promises of AI document SURF			
Perusall	Prepare students for courses through pre-reading compliance	Digitise students' accounts, profiles, and dashboards: producing info about seemingly countless data points	Promises of AI (SURF)
		Bias in grading for non-native English speakers	
		Transparency in how it grades, to not get students confused.	
Jill Watson	Virtual teaching assistant with a conversational agent aspect	Responsibility: what certainties can a student expect from Jill Watson?	Promises of AI (SURF)
		Access to good-quality data	
		No AI capable of answering every question	
Photomath	An app that scans math equations and shows an explanation	App from outside the educational system might have effects on academic integrity	Promises of AI (SURF)
Generative chatbots	LLM chatbot that calculated the likelihood of the next word	Academic integrity	Promises of AI (SURF)
		Qualification of students, when essays can be generated	