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Citation

Mikroyannidis, Alexander; Sharma, Nirwan; Ekuban, Audrey and Domingue, John (2024). Using Generative AI and ChatGPT for improving the production of distance learning materials. In: 24th IEEE International Conference on Advanced Learning Technologies (ICALT 2024), 01-04 Jul 2024, Near East University, Nicosia, North Cyprus, IEEE Computer Society, (In Press).

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Using Generative AI and ChatGPT for improving the production of distance learning materials

Alexander Mikroyannidis
Knowledge Media Institute
The Open University
Milton Keynes, United Kingdom
alexander.mikroyannidis@open.ac.uk

Nirwan Sharma
Knowledge Media Institute
The Open University
Milton Keynes, United Kingdom
nirwan.sharma@open.ac.uk

Audrey Ekuban
Knowledge Media Institute
The Open University
Milton Keynes, United Kingdom
audrey.ekuban@open.ac.uk

John Domingue
Knowledge Media Institute
The Open University
Milton Keynes, United Kingdom
john.domingue@open.ac.uk

Abstract—This paper explores the use of Generative AI and ChatGPT for improving the production of distance learning materials. We have conducted participatory design workshops involving cross-disciplinary teams of academics and different stakeholders, such as industry partners and learning material designers that are involved in course production at the UK Open University. The main outcome of these workshops is a set of use cases on how Generative AI tools, such as ChatGPT, can be integrated and augment the existing course production and delivery processes to make them more agile and efficient. Following the workshops, we have developed a proof-of-concept tool that can instantly generate introductions and summaries of course material, automatically generate quizzes and tests, as well as automatically identify, categorise, and transform learning activities. A preliminary evaluation performed with members of the course production teams indicated that in 40% of cases AI generated text of 250-500 words is suitable for use in distance learning materials. Overall, the evaluation participants welcome this use of Generative AI, but there are concerns mainly centred on potential for bias, misinformation, and copyright infringement in the generated learning materials.

Keywords—Generative AI, ChatGPT, personalised learning, higher education, distance learning materials

I. INTRODUCTION

For decades, the education community has been motivated by Bloom’s seminal 1984 study [1], which demonstrated that students taught 1-to-1 performed 2 standard deviations better than students taught in a standard classroom settings. Remarkably, the average student in 1-to-1 situation performed better than 98% of the students taught in the control group. Despite these clear benefits, personalised learning has been inaccessible due to socioeconomic issues posing a challenge to educational equity. The recent emergence of Generative AI offers new opportunities to democratise personalised learning. This technology has the potential to significantly assist both students and teachers and enhance the learning experience by enabling scalable personalised instruction. Moreover, Generative AI can reduce the workload of educators by automating routine tasks, thus enabling them to develop student-centred teaching strategies.

Generative AI refers to a category of Artificial Intelligence (AI) algorithms and models designed to generate new content, such as images, text, and music, that resembles human-created

content [2]. Generative AI utilises techniques such as deep learning and neural networks to mimic human creativity and produce outputs that are not explicitly programmed or predefined. The models are trained on vast amounts of data, learning the underlying patterns, and then generate new content based on those patterns.

A prominent example of a Generative AI tool is ChatGPT, a Large Language Model (LLM) capable of generating coherent and contextually relevant text. It employs a vast array of pre-trained language data, allowing it to simulate human-like conversations. GPT-4 is the latest publicly available LLM version used by ChatGPT. In addition to ChatGPT, several other Generative AI tools have emerged, each with its unique characteristics and applications. For example, models like DALL-E and Midjourney allow the creation of visually coherent images from textual user prompts [3].

The remainder of this paper is structured as follows. First, we discuss related work on the use of Generative AI in higher education. We then present the motivation and objectives of this work, followed by the participatory design workshops, the development of a software prototype, as well as the user evaluation. Finally, we discuss the lessons learned from this work and we conclude the paper with our plans for future work.

II. RELATED WORK

A comprehensive overview of the capabilities and potential of Generative AI to transform higher education has been published by UNESCO [4]. Sharples [5] outlines the different types of educational applications of Generative AI for facilitating cooperative and social learning. These applications include a Possibility Engine for broadening perspectives, a Socratic Opponent for engaging into argumentation, a Co-designer for engaging into a collaborative design task, an Exploratorium for exploring, visualising, and interpreting a database or design space, as well as a Storyteller for creating a story that represents a diversity of views, cultures, and orientations. Sharples envisions a distributed human-AI system, where learning happens when this system sets goals, builds meaning from data, consolidates understanding, reconciles differences, and transfers knowledge to new domains.

Researchers are also focusing their investigations on the impact of Generative AI and ChatGPT on certain aspects of higher education, most notably student assessment [6, 7]. These

studies have shown that ChatGPT can help educators provide personalised feedback of consistently high quality at a larger scale and in less time [6]. Additionally, these studies indicate the need to revise some outdated assessment practices, for example by introducing assignments that foster active student engagement and critical thinking [8]. The various limitations of Generative AI and the challenges it poses for higher education have also been explored by researchers [9, 10]. These studies point out that Generative AI comes with ethical considerations, such as the potential for misuse, or the generation of deceptive or malicious content [11, 12]. Issues related to data privacy, algorithmic biases, and the responsible use of AI generated content need to be urgently addressed by higher education institutions, especially since the use of Generative AI tools by students and educators is growing over time [11].

III. MOTIVATION AND OBJECTIVES

The UK Open University (OU) is one of the largest distance learning universities in the world, with over 200,000 students currently enrolled. The majority (70%) of these students work full or part-time during their studies, 28% of them live in the 25% most deprived areas in the UK. Furthermore, a significant portion (74%) do not have any previous higher education qualifications [13]. The OU is at the forefront of digital pedagogies and invests heavily on the production of high-quality learning materials, intended specifically for distance learning. Parts of these learning materials have been repurposed as Open Educational Resources (OER), and are freely available online as self-study courses on the award winning OpenLearn platform, which receives over 10 million visitors annually [14, 15].

To explore how Generative AI, specifically GPT-4, can enhance the production of distance learning materials, the AI Module Writing Assistant (AIMWA) project engaged five course production teams across multiple disciplines including all four faculties of the OU. The overall aim of the project has been the following:

To what extent can Generative AI transform OU course production to provide students with high quality, up-to-date and personalised learning materials for a lower cost than today?

In particular, the AIMWA project has been driven by the following objectives:

- *How can we best create high quality learning materials in an efficient manner?* Speed and agility are especially an issue for fast moving and often popular disciplines, such as AI and data science.
- *How can we personalise learning materials to best suit the individual needs of learners?* Historically, personalisation at the OU has been through human tutors and student facing support services.
- *How can we best adapt existing learning materials?* There may be small changes required related to discipline changes, or larger changes for a different target audience, for example when adapting content for microcredentials.

IV. PARTICIPATORY DESIGN WORKSHOPS

A series of 5 participatory design workshops were organised with the OU course production teams that were involved in the AIMWA project. Each workshop was attended by a different course production team, with a total of 37 participants across all workshops. All participants have been highly experienced in the production of distance learning materials for the OU and hold either academic roles or academic support roles. During the workshops, participants were first introduced to the various Generative AI tools and their capabilities. They were then asked to work in small groups to identify challenges in the current OU course production process and brainstorm use cases on how Generative AI and tools like ChatGPT can support them in the creation of educational content and enhancing student learning.

A total of 150 use cases were generated by participants. These have been clustered into the use cases that are summarised below:

- *Real time digital assistant:* a 24/7 ‘live’ digital assistant able to answer questions about the course and provide support to students.
- *Personalised learning:* tailor-made learning pathways created to suit each student’s current context and preferences.
- *AI avatars* for students to practice skills or gain confidence. For example, for psychology students to practice interviewing clients in counselling courses, or for students to gain confidence and skills in interacting in online forums.
- *Self-assessment,* including generation and marking of simple self-assessment exercises, such as quizzes.
- *Automatic summarisation* of any highlighted material presented at different levels, for example “Explain this concept to me as if I’m 14 years old”.
- *Automatic language translation* to support teaching of languages and for students who do not have English as a first language.
- *Automatic content update* to the state of the art. The OU is running a national service that semantically links around 300 million research papers. This service has been recently connected to Generative AI to enable the automatic generation of ‘state of the art’ summaries for education topics [16].
- *Activity generator:* generation of activities according to one of the seven activity types that are commonly used in the OU distance learning materials: assessment, assimilative, communication, experiential, information, interactive, productive. Also, the automatic transformation from one activity type to another.
- *Content writing assistant:* generation of introductions and summaries of sections, checking style and conducting light editing.
- *Automatic image creation,* including graph creation. Generative AI tools such as Midjourney, DALL E 2 and

Stable Diffusion can support image generation and image editing. Graphs can be generated using a textual graph language.

- *Educational video transcript generation* that can be used by ‘digital human’ avatars, such as UneeQ. This combination provides the basis for an AI Digital Assistant.
- *Brainstorming companion* for initial drafts of learning materials. Generative AI can alleviate the ‘tyranny of the blank page’ and help the course production teams by generating initial ideas for learning materials.

V. SOFTWARE PROTOTYPE DEVELOPMENT

As the AIMWA project involved the use of course materials owned by the OU, it was deemed necessary to use a Generative AI tool owned and controlled by the OU, instead of a third-party Generative AI tool, such as ChatGPT. Following the participatory design workshops, a bespoke software prototype was designed based on the requirements of the use cases generated by the OU course production teams. The resulting AIMWA software prototype performs a range of functions: automatic generation of introductions and summaries of course materials, automatic generation of quizzes and tests, as well as automatic identification, categorisation, and transformation of learning activities. The study described in this paper is focused on the automatic generation of introductions and summaries of OU course materials.

Rapid prototyping has been key for developing the interface and the prompts of the AIMWA software prototype. We assigned the LLM the role of a module creator at the OU and provided a realistic context through information such as faculty, school, and module name. The main tasks of the LLM were to generate introductions and conclusions for specific units by following the instructions of predefined prompts. The prompts for generating introductions focussed on using engaging language for introducing concepts and outline learning outcomes. Additionally, the prompts for generating conclusions emphasised simplicity and informativeness, summarising key points ensuring alignment with educational goals.

Discipline-specific summaries were generated through iterative prompt engineering, with human-authored text ranging from 200-1400 words and AI-authored text varying from 230-492 words. This approach allowed us to refine our prompts by comparing AI outputs against expert summaries to ensure coherence, relevance, and pedagogical value. The process effectively fine-tuned the LLM’s performance and created summaries like existing human authored content.

Figure 1 shows one of the prompts that was developed using this technique. The front-end of the interface was kept simple with drop-down menus for selecting the module, unit and specific prompts that were suggested. The user could further edit the prompts before sending them to the LLM to generate summaries. After generating summaries, the user could interact further with the output to further refine it. We utilised the Retrieval-Augmented Generation (RAG) AI framework [17] to send module context with the prompts. This technique ensured that the LLM had access to the underlying course material

(without the summaries) in order to generate summaries based on OU content, thereby maintaining accuracy and reliability in the generated summaries.

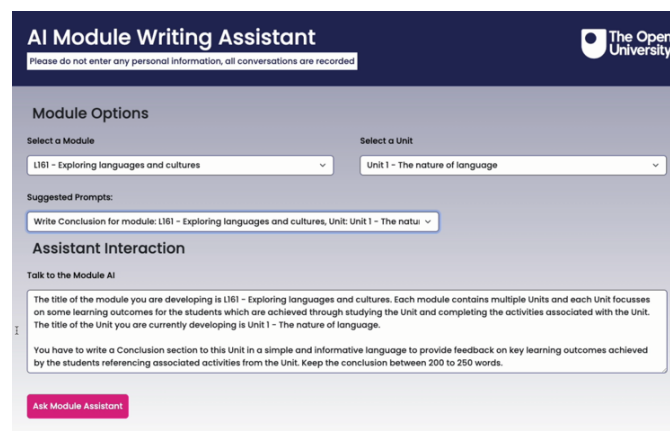


Fig. 1. User interface for generating content summaries for the AIMWA project. The interface includes drop-down menus for selecting modules and units and suggests prompts for the user. The user can edit these prompts before submitting them to the LLM.

VI. USER EVALUATION

For the user evaluation of the AIMWA tool, we utilised purposive sampling to recruit participants. The members of OU staff that participated in the participatory design workshops and are involved in module development were contacted to perform the task evaluation and respond to a survey. The participants were best suited to evaluate content summaries, comment on how AI technologies could improve their workflow for content generation, enhance learning experiences, identify challenges for technology adoption in terms of training, and any potential risks of introduction of the technology.

The evaluation comprised of a survey and a structured task evaluation. The task evaluation comprised of a blind comparative analysis of content summaries generated by both human experts and AI. A Likert scale ranging from one to five stars was used to quantitatively assess the text on the dimensions of comprehensiveness, accuracy and writing style. Participants were also tasked with discerning the AI-generated content and with providing the rationale behind their identifications. For each summary they were also asked whether they would incorporate it into the module.

Following this task, participants were invited to interact with the AIMWA tool (Figure 1) and provide feedback on their user experience. Through open ended questions the survey captured feedback regarding the tool in various pedagogical contexts. For a robust evaluation, the selection of participants was cross-disciplinary matched with their discipline specific task summaries and AI prototypes. In total, 10 survey responses were collected and 30 content summaries were analysed.

Figure 2 highlights that the human authored texts were preferred across all 3 dimensions, i.e., comprehensiveness, accuracy and writing style. Additionally, the AI authored texts did receive scores of 3 or above, which indicates that their comprehensiveness, accuracy and writing style are above average. Specifically, the AI authored texts received the lowest

score (3) for their writing style. This is to be expected, as the writing style of the OU learning materials is distinctive and is kept consistent across the different OU course production teams.

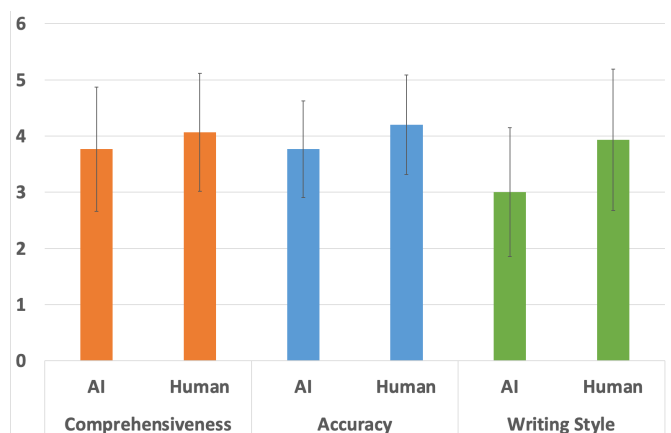


Fig. 2. Average ratings across the module summaries comparing AI and Human authored text.

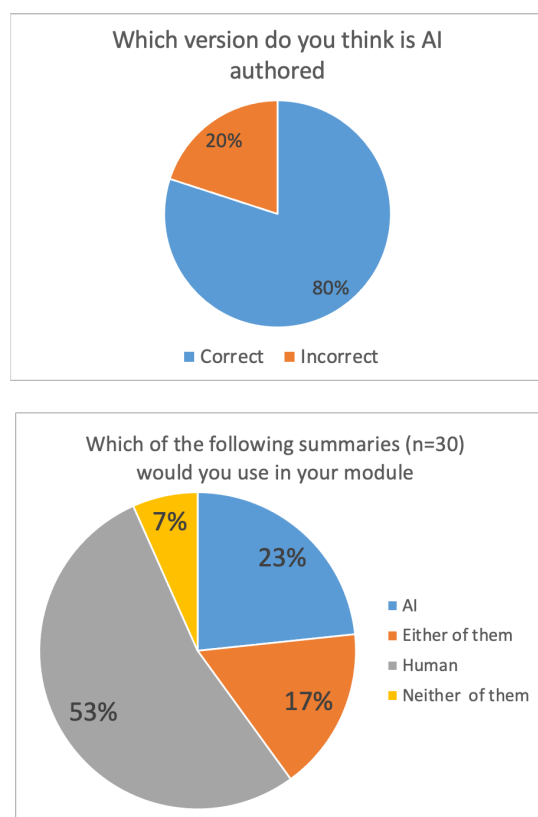


Fig. 3. Pie chart distribution of participant responses regarding AI-authored content identification and the usefulness of summaries for their respective module.

Figure 3 shows the results of the survey questions regarding the identification of AI authored texts by the evaluation participants, as well as the preferences of the evaluation participants on using AI and/or human authored texts in their learning materials. In most cases (80%) participants have correctly identified the AI authored texts over the human authored ones. When asked to justify their choice, participants

commonly distinguished the human authored texts over the AI authored ones based on their writing style, their structure and length. In 53% of cases, participants would use the human authored texts in their modules. However, it is noteworthy that in 40% of cases, the AI authored texts have been deemed suitable for use in the OU learning materials.

Based on their experiences from using the AIMWA tool, participants were asked to express their views on whether Generative AI can improve course production and how. Most responses were positive, with participants mentioning the capabilities of Generative AI to automate some time-consuming tasks, such as providing summaries of human authored content. However, most respondents agreed that Generative AI is not suitable for use as a fully autonomous tool for authoring learning materials. Several participants indicated that they would like to use Generative AI as an ‘assistant’ that can help them with certain aspects of course production. Some indicative responses are the following:

Yes. I think it can significantly speed up the writing process, automate elements of QA [Quality Assurance] and assist with intelligent asset re-use, among other things.

Yes, to review content, to update content (with proviso that it is all fact-checked by human) and to provide summaries of content.

It might be helpful for some routine tasks but not anything that requires careful wording, or pedagogical consideration.

Not as a writing tool, no, but it may have other uses (e.g. producing plausible human-like text for students to practice qualitative analysis). Even there, though, I have my doubts. Qualitative analysis looks for meaning, and the AI has no sense of meaning to convey.

Participants were also asked to express their views on whether Generative AI can improve the learning experience of the OU students and how. Similarly to the responses to the previous question, most responses were positive. Participants indicated that Generative AI could help students by providing them with personalised support and guidance. More specifically, participants suggested that Generative AI could be embedded in the existing OU learning platforms to offer services such as summarisation and explanation of learning materials, creation of study plans, as well as helping students develop critical thinking skills. Some indicative responses are the following:

Yes, absolutely - I think this is an even more promising frontier than production, in fact. I worked with a group during one of the workshops to put together an overview of how we thought an AI study assistant could be embedded in existing module platforms.

Yes, but awareness of bias, accuracy, etc. needs to be addressed. AI tutor could be very powerful to give personalised feedback. Generating ideas; summarising difficult texts; creating study plans; etc. are all useful ideas. Tutors will need guidance and support on how to adopt assessment strategies to incorporate use of AI and the skills it requires to use effectively, i.e. reflection, analysis, fact-checking, rewriting, comparing versions, editing, etc.

Yes, it helps to develop students critical thinking by analysing writings generated by AI and compare it with a human piece of work on the same topic; it can also help students to quickly locate the information they need.

It can help students rephrase material if they are struggling to understand something.

Yes. Providing accurate 'on demand' information about parts of the module that might not be easy to find or to understand.

VII. LESSONS LEARNED

In harnessing the potential of Generative AI for improving the production of distance learning materials, a paramount consideration lies in ensuring that the use of Generative AI aligns with established pedagogical frameworks, demands meticulous planning and transparency, and leverages existing high-quality learning materials. By embracing these principles, higher education institutions can navigate the complexities of integrating Generative AI into their teaching and course production practices, while maximising its potential for enhancing the student experience. In particular, the lessons learned from this study are the following:

- *Pedagogically driven AI solutions.* It is important that any uses of Generative AI for teaching and course production are based on and driven by established pedagogies. For this reason, it is also important that stakeholders, especially experienced educators, are consulted before any decisions are taken about the use of Generative AI at an institutional level.
- *Roadmapping.* The introduction of Generative AI in the teaching practices of a higher education institution requires considerable effort and can be quite disruptive. It should therefore be well thought and justified in advance, by defining clear objectives and a detailed implementation roadmap with milestones and performance indicators.
- *Transparency.* The provenance of any AI generated learning materials should be clearly signposted, including the seed data and prompts that were used to generate the materials.
- *Content is king.* The use of existing high-quality learning materials in conjunction with the RAG framework is a critical factor for eliminating incorrect information (also known as 'hallucinations') and improving the quality of the AI generated content.

VIII. CONCLUSIONS AND FUTURE WORK

We have presented a preliminary study on the use of Generative AI for improving the production of distance learning materials. The results indicate that Generative AI holds significant potential to transform the existing teaching and learning practices in higher education. However, concerns regarding the pedagogical value of such a transformation should be carefully considered by higher education institutions. The lessons learned from this study indicate that the use of

Generative AI in higher education needs to be pedagogically sound, and therefore requires meticulous planning and transparency, as well as attention to the quality of the produced learning materials.

This study is the first step towards understanding the potential of Generative AI in relation to the production of distance learning materials. The next steps of this work will involve the development of additional software prototypes based on the use cases generated by the OU course production teams, as well as the piloting and evaluation of these prototypes with OU students and staff. The results of this work will provide best practices and a comprehensive framework for higher education institutions navigating the integration of Generative AI into their current practices.

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