Students' AI-generated Images: Impact on Motivation, Learning and, Satisfaction

Cornelia Berg[1], Liv Omsén[1], Henrik Hansson[1] and Peter Mozelius[2]
[1]Stockholm University, Sweden
[2]University of Gävle and Mid Sweden University, Sweden

henrik.hansson@dsv.su.se

Abstract: In the contemporary society where the rapid development of generative AI (GenAI) infiltrate daily life, it is imperative for schools to keep up with the development. Future generations are expected to have GenAI skills and knowledge in the same way that traditional literacy is a recruitment condition today. School curricula need to integrate this new technology to support students' learning and development. Research on artificial in education (AIED) has reported on the challenges with the involvement of GenAI in teaching and learning, but also on GenAi as a study support. To not fall behind many schools have started out with AIED initiatives which creates a need for studying how GenAI could be applied in a useful way in teaching and learning activities. The research question that guided this study was: In what ways could the use of GAI in visual form support students' learning process and motivation in upper secondary school settings? The overall research strategy was a qualitative case study approach with investigator triangulation. Data were collected in a combination of observations at workshop sessions and semi-structured interviews. with teachers as well as students. In a six-step inductive thematic analysis data excerpts were coded, aggregated to categories, and presented. Findings indicate that GenAI tools for image generation, can have a positive effect on learning. At the same time that memorisation of information is supported, there were also a positive impact on motivation and student satisfaction. The involvement of image generation tools not a substitute, but rather a complement to traditional teaching and learning activities. The conclusion is that the use of AI in education can offer new learning opportunities, and with the increased use of GenAI, it is crucial for both students and teachers to keep pace. However, this would require that more time and resources for teacher professional development on AIED.

Keywords: Generative AI, GenAI, AIED, AI-generated images, Midjourney, Secondary education

1. Introduction

The rapid development of generative AI (GenAI) reaches many areas where education is one of them. Important to keep up with the introduction of new tools and techniques and to look at the opportunities that open up for an enhancement of teaching and learning activities. As highlighted by Chiu (2023), GenAI tools such as ChatGPT and Midjourney have a potential to make a strong impact on several aspects of education. Rather than seeing GenAI as only a threat, the traditional education system could be reinforced by introducing GenAI tools as study companions (Zarris & Sozos, 2023; Farrelly & Baker, 2023), and that the threshold for students to use GenAI is low (Sullivan et al., 2024). There are also studies discussing the potential of using AI as a teacher assistant (Humble & Mozelius, 2019; Parab, 2020), and as pointed out in the study by Zarris and Sozos (2023), GenAI tools can be both study companions and teacher assistants. GenAI involves systems that generate content based on multi-layered neural networks that can identify and imitate patterns, styles and structures that has been a part of the systems training data (Farrelly & Baker, 2023).

Many recent research studies have focused on how GenAI trained on large language models generates textual output (Barreiro et al., 2024), and the benefits of GenAI in language learning (Roe, 2024; Thorne, 2024). As argued by Law (2024), many studies have highlighted the potential of GenAI chatbots as personalised language learning partners. However, GenAI is a multimodal technique where the output could be text, sound, music images or video (Rabowsky, 2023; Huang, 2023). In parallel with the release of a wide variety of AI tools with different modal outputs there is a need for research on how they could be applied in a useful way in teaching and learning activities. As suggested by Johnson (2023), GenAI tools could be a way of accelerating learning, but with the risk of misleading learners with wrong information. During the last years many image generating tools have been released such as DALL·E 3, Midjourney, Stable Diffusion and Adobe Firefly. Midjourney is one of the image generating tools that has been evaluated to have both a high output quality and a user-friendly interface (jie et al., 2023; Turgay et al., 2023).

Midjourney is also one of the tools that several times has been part of some recent studies on GenAI in educational contexts (Chen et al., 2024), and it was the chosen tool for this study. The aim of this study was to explore the impact of involving GenAI tools in upper secondary school activities and to analyse how AI supported image generation might stimulate motivation and creativity. The main research question to answer was: "In what ways could the use of GenAI in visual form support students' learning process and motivation in upper secondary school settings?"

2. GenAI in educational contexts

GenAI can potentially act as a study companion for future generations. With the help of various AI technologies, complex concepts can be explained, advanced questions answered, and new study techniques based on course content created (Farrelly & Baker, 2023). As society becomes digitalised, it is important to keep students motivated and provide them with the skills to navigate in an innovative society (Byundyugova et al., 2022). At the same time, research highlights the importance of creative thinking in school (OECD, 2019a; 2019b) and how visual literacy increases motivation to learn (Kaya, 2019). Technologies are evolving and becoming more complex, which may result in visual communication playing a greater role (Kaya, 2019). Furthermore, in the PISA 2021 *Creative Thinking Framework* (2019b) PISA highlights the importance of training students in their creative abilities. A student trained in creative thinking may find it easier to adapt to the future we are facing and deal with more complex challenges and find innovative solutions both locally and globally.

A digitalized society also places demands on the school that students and teachers possess the skills required to keep up with the development of society. The school should help a student to feel that they are part of today's society and that their resources can contribute to development (OECD 2019b). Furthermore, the school is facing an educational renewal and change in the school's operating culture. Research shows that students prefer technological platforms to physical books and teachers prefer platforms such as Google Classroom and Moodle (Chen, Xiw & Hwang, 2020). The development of intelligent technology is changing the whole school structure, operation and governance (Chen, Xiw & Hwang, 2020). It is becoming more difficult to determine what is reality and what is AI and therefore society must collectively find new ways of working, learning and studying as GenAI will become a major part of our everyday lives (Farrelly & Baker, 2023).

AIED (AI applications in education) involves various tools and applications with AI for students and teachers whose purpose is to support current teaching (Chen, Xiw & Hwang, 2020). In Sweden, artificial intelligence will be a new subject in upper secondary school and KomVux (Municipal adult education) from autumn 2024. The aim is to teach AI from a societal perspective and how AI can be used for problem solving. The Swedish National Agency for Education states that teachers are interested in how technology can be integrated into current teaching. New technological tools, including GenAI technology, are introduced in schools and affect how students think, work and students' learning ability. Examples of GenAI tools are Midjourney which generates images based on the user's textual description (Yanbo & Chuanlan, 2024) and ChatGPT which has become a major part of the school just in the last year. Despite a great deal of criticism towards the tools, some argue that it also brings positive aspects. Moreover, this type of technology will be part of our everyday lives whether we like it or not. If used correctly, GenAI technology can be revolutionary and accelerate our learning (Johnson, 2023).

Visual creation in school environments creates motivation in students. Pisa believes that motivation is a key in creative thinking and it can be measured in the engagement a student feels towards a task or lesson (OECD, 2019b). An engaged classroom is often a result of so-called active learning which means that students are involved and challenged to reflect on what they are doing and why (Bonwell & Eison, 1991). Furthermore, the classroom should be an innovative, permissive and inspiring environment that challenges students in their creative thinking, cognitive knowledge and openness to new ideas (OECD, 2019b). Previous research emphasises that allowing students to be creative and independent when working on tasks also contributes to a supportive environment during lessons (Bonwell & Eison, 1991). The relationship between creativity and education can be seen as natural and historically creativity has been important in schools (Smith & Smith, 2010). Creative learning involves techniques teachers use to help students learn new material that they can later apply to new problems. Finally, creative learning is about how students use strategies to process new information (Mayer, 1989).

3. Method and sample

The used research strategy was a qualitative case study approach with multiple data sources analysed by investigator triangulation. Data were collected in a combination of observations at workshop sessions and semi-structured interviews. with teachers as well as students. A case study is recommended when there is one phenomenon, or a few phenomena, that should be investigated in depth, with the aim of establishing a deeper understanding for events, experiences, relations and processes (Denscombe, 2014). Furthermore, case studies are often used to explore and discover a new information field, which also was the purpose with this study.

3.1 Sample and data collection

Observations involved nine students, aged 17 to 18 years, who were enrolled for the second year at an upper secondary school in central Stockholm. Students were observed when writing prompts and generating images in the GenAI tool Midjourney. After the observations four of the students answered questions in a semi-

structured interview about their perceptions of the image generation. Moreover, a semi-structured interview was conducted with the teacher in the video conference system Zoom since there was no time to do the interview the same day as the student interviews were conducted at the school. All the interviews were recorded and later transcribed by two of the authors. Interviews were conducted in Swedish.

The observations were conducted in a workshop setting where students were working in pairs, but with their individual computers. Three images should be generated and discussed, where the first one was generated without any instructions to the students. For the second image they were encouraged to enhance the prompting, and then to compare the results. Finally, for the third image the instructions were instructed to formulate a prompt for an image with relations to a societal or historical theme.

Image 1. Midjourney generated images of Winston Churchill when he was elected Prime Minister

3.2 Data analysis

The collected data were analysed in a six-step inductive thematic analysis as outlined by Braun and Clarke (2006). A thematic analysis is a frequently used method for identification and analysis of patterns and correlations in a data set. This was used in this study both for the interviews and the observations. The aggregate data were analysed and grouped into categories that have a potential to answer the research question. According to Braun and Clarke the first step is about familiarising yourself with the data, which started out in the transcription of interviews and the editing of notes. In the next step code excerpts that had a potential to contribute to the answering of the research question were marked for further analysis. This was followed up by a step where the identified patterns and codes were aggregated to subcategories and preliminary categories (themes). Then the preliminary codes were revised and checked for consistency before the final naming of the categories. Finally, a narrative presentation of the found categories were created with the idea of explaining the relevance of the categories and their relationships.

3.3 Ethical considerations

This study has followed the ethical guidelines from the Swedish Research Council (Vetenskapsrådet, 2017, p.40). The study has strived to keep all involved as anonymous as possible and all personal information about teachers and students were removed early in the process, or never entered, to eliminate the possibility of connecting any images or answers to specific individuals. Moreover, all participation in the observation was conducted on a voluntary basis, with the right of withdrawal without any explanation at any stage of the process. According to the guidelines of informed consent, all informants have signed a form with information about the study. An important aspect for this case study was to consider the specific ethical guidelines for upper secondary school students. According to Integritetsskyddsmyndigheten / The Swedish Authority for Privacy Protection (IMY, 2024), students over 16 years of age have a certain legal capacity (rättshandlingsförmåga), and could in general give their consent without signatures of the parents or guardians.

4. Results and discussions

Observations in classroom sessions and follow-up interviews provided the themes or categories of: 'Active learning', 'User-friendliness,' 'Motivation and learning outcomes', 'Critical thinking', and 'Integration in classroom activities'. The found themes are presented and discussed one by one here below.

4.1 Active learning

Students found it very motivating to actively create their own AI images, it was expressed by a student in this way: "*You are the one who creates and it will be more fun than sitting and looking at other pictures*." The oral classroom discussions based on prompts and images further discloses students actual understanding and expands it. Another process, which can reinforce learning, is the iterative process towards a more accurate image; writing additional prompts to improve the accuracy of the image. This refining process is supporting the learning process; when writing a prompt - viewing an image, critically assessing it and rewriting the prompt to get a better result - the learning increases. *"You can do it together and discuss, we create a picture together, absolutely a good learning technique, find five errors and correct them"* (Teacher). A method which could be used in education is comparative analysis of images, comparing students' images with real and authentic illustrations.

There are important learning aspects which may be less tangible to assess as a teacher, but nevertheless are important for the learner. One student expressed that he acquired a deeper and more empathic understanding of war conditions when viewing images. A subject which traditionally has been taught by using texts and statistics. *"We have worked a lot with history and if you see a picture of what it was like in the trenches, for example, you get a completely different perspective on what it was actually like. And it may not be part of how I will answer the question, but it gives me a better idea of how it actually was."* Teachers saw significant potential in using AI tools like Midjourney to foster collaborative discussions and enhance understanding of historical and literary contexts. The ability to generate visual aids was seen as a powerful complement to traditional teaching methods.

4.2 User-friendliness

All students agreed that Midjourney was easy to learn and use. "I thought it was easy to start writing and it was easy to understand how the program works, especially when you got to test it once because then you saw how it reacts to what is written in the prompt." The quick adoption and understanding of how to use the system by students differ from the teacheŕs view, who stated time constraints as a major limit for exploring and learning new tools and approaches. It is a bit strange that learning professionals, i.e teachers, find it harder to learn new things than their students. The teacher's opinion was that AI takes time to learn, but that it on the other hand accelerates learning and thereby saves time. What is the definition of 'Education'? Well, there are many but one is 'accelerated learning'.

Most things can be learned without formal education, but the advantage with education is that with the structure, content, mentoring etc provided in education, the learning journey is faster. AI can greatly increase learning speed in almost all subjects. The teacher in this study is probably more open minded than most teachers, some definitely against digitalisation. "There is a trend in school where there are those who feel that we should go back to students having paper and pencil, not only writing on screen but also by hand, because it provides more learning. I think it is a complement and there must be both, the school will become more digitised and teachers think it's fun". The primary challenge that remains is the limited time available for teachers to familiarise themselves with new AI tools and to train students in their use. This necessitates a strategic approach to professional development and resource allocation within schools.

4.3 Motivation and learning outcomes

All students agreed that images improved learning. "It becomes easier to write and understand instead of remembering texts. I find it easier to remember if I link an image to a text. If I were to write a text and get a picture, I could remember the picture and connect the words I wrote to create it to it and then remember better." There is a risk of learning wrong based on incorrect pictures, but even a biased picture could be useful as a trigger for classroom discussions, analysing what is right with this picture? What is wrong with this picture? In such reflections, using student generated pictures with teacher guided analysis in discussions students can move from rough and superficial understanding to deeper and more critical understanding.

In fact, analysis of the image is also an analysis of the prompt that student wrote to generate the image, which is an indication of the current state of his/her understanding. Moreover, students claimed that Midjourney facilitated learning by making it easier to memorise information and understand complex concepts. The visual

nature of the tool was particularly effective in enhancing engagement and motivation. The effectiveness of Midjourney varied depending on the input data. While it successfully generated realistic images for certain historical events, it struggled with others, highlighting the importance of accurate and relevant input data. Results also indicated that students developed visual literacy skills, which are crucial for interpreting and analysing AI-generated images. This ability is seen as equally important as traditional literacy skills.

The use of Midjourney GenAI images in this study released creativity and intense activity by the students who immediately embraced the technology. There is a tension between creativity and control of the learning processes, on the one hand open mind, think out of the box, generating new ideas and on the other hand controlling what is true, what to be trusted, how to judge, how to assess and award grades. Obviously, students like the creativity aspect which is engaging, new, student centred and motivating. From the teacher's point of view engaged and motivated students are positive aspects of course, but there are concerns about how to control the learning process, the accuracy of results, how to keep abreast with the new technology and be ahead of students. Changing teaching and learning activities is not only about time, it is also about willingness to change.

4.4 Critical thinking

Several students remarked that the AI generated images are not real authentic illustrations, therefore, in order to acquire deep and correct knowledge other sources of information are needed. They also stressed the importance of writing correct and relevant prompts in order to get a useful and trustworthy illustration of the topic. Knowing how to write efficient and correct information is a key skill which is not provided by the AI tool, but rather still a teacher´s/advanced learner´s skill. *"One should not rely entirely on AI, so perhaps not as the primary study tool. You also have to use other information to understand that it is not only what is shown that is the truth, because it is still a fake picture."*

In order to write a good prompt, one has to know a lot already, the importance of pre-knowledge and the ability to critically assess the GenA image result based on previous knowledge is emphasised. *"You have to know a lot of things to use it in a good way. For example, you have to make a house, or like this task a house in Jon Utzon style, now she got a house that matched well, but then she had given more information, and looked at lots of pictures and knows what it should look like".*

Students found that Midjourney facilitated learning by making it easier to memorise information and understand complex concepts. The visual nature of the tool was particularly effective in enhancing engagement and motivation. Despite these benefits, there were concerns about the potential for AI to distort reality. Students and teachers emphasised the need for critical thinking skills to accompany the use of AI-generated content. Basic skills in the field of AI generated images can also be a way to reinforce critical thinking in the emerging field of "deepfakes" (Mutillo-Ligorred et al., 2023).

4.5 Integration in classroom activities

Gen AI for image generation could be used for individual learning activities, memorisation, classroom discussion and as a basis for process examination as well as final examinations. The teacher suggested that prompt texts could be a basis for grading. *"A student can show through a prompt so I as a teacher can see what he/she has changed in the picture, it could be assessment material if that is what you are looking for".* Actually, there are reasons to believe that how to use AI will be a general lifelong skill required in future work life and therefore should not be banned in education but rather encouraged. Students turn to the Internet to learn about how to write prompts as a Pro, since the teacher has limited knowledge. *"If you have classes where you learn how to write prompts and learn the basics and you do that then it's bound to be good. [...] I found a guy on TikTok who was a prompt pro so he was a pro at using AI and for me it was a bit weird that there are already those and then I thought that's probably a very good thing to learn and invest in it"*

The teacher had several innovative ideas of how to use GenAI image generating for student activities in different subjects: in literature students could generate images illustrating the novel they read, in history they could illustrate correctly the time period - 16th century London compared with 19th century London - for example, and in architecture/art they could illustrate houses built in a special style. The teaches explains a student activity including GenA image creation and being able to argue and defend that the image is correct:

> *"Let's say it would be an assessment situation, then maybe I could ask the students to create a certain scene in history and when the student feels that he/she have created a scene that describes it, for example the Second World War, or it could be [more specific] the Battle of Lutzen and then the student has to argue why he/she think this picture is a good answer, in this way we could work"*

While the students mainly raised positive aspects of using GenAI, the teacher was more reserved. Time and organisational constraints, a dystopic future and….. was mentioned by the teacher. *"We don't really have the time to continue our education, it goes so fast, the school is behind in that way, here you have to freelance as an individual teacher and just decide that you think it's fun to try, even though you don't master it", and that "Schools haven't really caught up, there are still teachers who have learning tasks made by AI, and we are facing some kind of tipping point and schools need to give time for teachers to sit and learn the systems"*

> *"Students are ahead of us, it's hard to keep up. But as teachers, you contribute with critical thinking about how they use AI, but it requires that teachers are given space to further train in this. Now the new curriculum will also be added and will mean that teachers must learn them and change the subjects how we should think, the time that is available in school will now be used for that, and then there is not much time for AI".*

5. Conclusion

In conclusion, AI image generating tools like Midjourney can enhance student learning by making learning more student centred, interactive, fun and engaging. However, critical analysis and open discussions with the teacher about the validity of images generated by students are important in order to arrive at correct understanding and conclusions. Successful integration of such technologies requires addressing the time constraints faced by teachers and ensuring that both students and teachers are equipped with the necessary skills to use these tools creatively, critically and effectively. The integration of AI in education should be accompanied by efforts to enhance students' critical thinking skills. While AI offers numerous benefits, it should complement rather than replace traditional teaching methods. Human judgement and interaction remain essential components of effective education. Future research should focus on expanding the sample size and exploring long-term impacts of AI integration in various educational contexts to validate and generalise these findings.

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