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## Exploring Faculty and Students' Ethical Uses of GAI in Teaching and Learning Focusing on Bloom's Taxonomy and the Needed Skills Development

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### Abstract

Artificial Intelligence (AI) research started about seventy-five years ago. Since then, this transformative technology and its related platforms have significantly and mostly positively impacted our daily lives. Many industries and businesses as well as some public sector agencies have adopted this technology. Now more than ever before, AI is impacting education at all levels. In this article, we will discuss ethical applications of GAI-based platforms in teaching and learning by faculty and students focusing on Bloom's taxonomy. We will present a brief description of some GAI-based platforms. We will also discuss the required training for faculty and students to be able to develop the required skills for ethically using GAI in teaching and learning that meets the learning outcomes consistent with Bloom's taxonomy.

**Keywords:** GAI in teaching and learning, Bloom's taxonomy, faculty and students GAI ethical use literacy, GAI skills development

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## 1. Introduction

Artificial Intelligence (AI) research started about seventy-five years ago. Since then, this transformative technology and its related platforms have significantly and positively impacted our daily lives. Many industries and businesses as well as some public sector agencies have adopted this technology. The wide availability of large amount of data has made significant contributions to the growth and utilization of AI. The focus of many industries in the use of AI has been for process automation (Lu, 2017). We use them in our homes, offices, and cars to automatically monitor our security, controlling and adjusting temperature, improving sanitization, buying and selling products, monitoring our health and wellness, entertainment, as well as now more than ever before in education. AI has been incorporated into search engines, mobile personal assistants, and other useful applications.

Since November 30<sup>th</sup>, 2022, when the San Francisco-based AI company, OpenAI, announced the release of their ChatGPT (Chat Generative Pretrained Transformer – <https://chat.openai.com>) platform several other platforms have been developed and are available to the public. These include and are not limited to:

- DALL.E 3 ([DALL·E 3 | OpenAI](https://openai.com/dall-e-3)) which creates images based on user's prompt
- CoPilot AI ([www.copilotai.com](https://www.copilotai.com)) that is integrated with Microsoft 365 products; helps in creating contents, suggestions, and automating tasks among other functions
- Google's Gemini (<https://gemini.google.com>) a general dialogue model
- Stable Diffusion (<https://stablediffusionweb.com>) a text-to-image diffusion model
- Whisper, an automatic speech-to-text converter by OpenAI, not fully released yet by OpenAI
- DreamFusion, (<https://dreamfusion3d.github.io>) a text-to-3Dimage generative model
- BERT (Bidirectional Encoder Representations from Transformers (<https://github.com/google-research/bert>) an open-source machine language processing

In section two, we will discuss ethical applications of GAI-based platforms in teaching and learning by faculty and students focusing on Bloom's taxonomy. We will present a brief description of some GAI-based platforms in section three. In section four, we will discuss the required training for faculty and students to be able to develop the required skills for ethically using GAI in teaching and learning that meets the learning outcomes consistent with Bloom's taxonomy. A summary and conclusion is presented in section five.

## 2. Ethical Uses of GAI in Teaching and Learning Focusing on Bloom's Taxonomy

Over the years, many technologies and innovations such as the Internet, the Web, and online education have made positive impact on teaching and learning. There is no doubt that GAI-based platforms and innovations will continue to have major transformative impact on teaching and learning as well. The impact of these technologies and innovations in higher education are not limited to teaching and learning but also on other areas such as programs' marketing, routine application processing, admission, faculty and staff recruiting, on and off-boarding of faculty and staff, and other routine HR related tasks.

The Bloom's taxonomy (Bloom, 1956; Hosseini, 1993) was originally focused on creating a common approach for educators to deliberate about learning and assessment. It is often presented as a 6-level pyramid with each level building upon the level below it. The levels are:

- a) Remembering and recalling relevant information that results in gaining **knowledge**
- b) The ability to explain the meaning of information that indicates **comprehension**
- c) Using concepts in concrete circumstances for executing or implementing that is **application**
- d) The ability to break down a whole into parts which is **analysis**
- e) Combining parts to create a whole that is **synthesis** and
- f) Assessing and examining based on sound measures which is **evaluation**

As is apparent from the above description, the knowledge level is a pre-requisite for the other five levels which are

primarily related to developing skills and abilities to accomplish tasks.

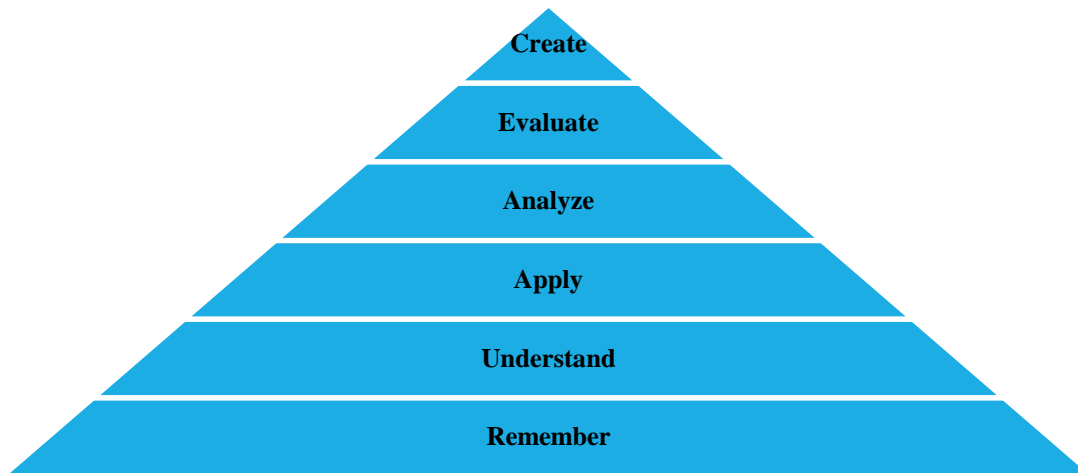


Figure 1. Bloom's Taxonomy

Bloom's taxonomy is used by educators to set the skills and outcomes expected from learners. We focus on how GAI can be used to facilitate achieving the expected outcomes.

## 2.1 Use of GAI Tools by Faculty and Students to Achieve Bloom's Taxonomy Learning Outcomes

The first level is remembering. This level consists of the ability to retrieve, recognize, and recall the necessary knowledge from one's long-term memory to facilitate understanding of a concept. Educators can use GAI tools and technologies to better prepare content and write lesson plans as well as learning outcomes. This process combined with highlighting the main points results in preparing more effective presentations using GAI tools. Similarly, learners can better summarize and organize course content using GAI tools in ways that fit their cognitive styles and preferences. The following prompts are examples for faculty and students for the first level of Bloom's taxonomy.

*Faculty.* Write a lesson plan for the first lecture in a junior level MIS course in data analytics.

*Students.* Create flashcards to review definitions of network topologies.

The second level is understanding. This level requires the ability to use various means of communication including oral, written, and graphic to construct meaning. As described in section one above, various GAI tools are available to create images based on a user's prompt, create 3-D images from text, or convert speech to text. These tools allow educators to create an environment that fosters improved understanding as well as for learners to select the type of information communication that best fits their learning style. The following prompts are examples for faculty and students for the second level of Bloom's taxonomy.

*Faculty.* Present data visualization concepts in various communication modes to fit different learning styles.

*Students.* Generate a set of images and text to use in a slide presentation on strategic implications of information technologies for large organizations.

The third level is applying. It requires using particular processes to execute or implement tasks. Developing assessment

tools is an essential part of any educator's activities. GAI tools can be used to write good assessments based on specific learning outcomes.

The following prompts are examples for faculty and students for the third level of Bloom's taxonomy.

**Faculty.** *Write ten multiple choice questions to assess learners' understanding of data visualization concepts and applications.*

**Students.** *Create an entity-relationship diagram for a sales order system for use by an online retailer.*

The fourth level is analyzing. This level involves breaking the whole into parts and deciding how the parts correlate and bond to one another. Using appropriate prompts, various GAI tools effectively facilitate this process.

The following prompts are examples for faculty and students for the fourth level of Bloom's taxonomy.

**Faculty.** *Create an essay assignment in which students are asked to analyze the use of information technology in an industry of their choice.*

**Students.** *Select a marketing data set and create a line graph, a bar chart, and a pie chart. Analyze the effectiveness of each and discuss their strengths and weaknesses.*

The fifth level is evaluating. This level involves using specific benchmarks and conditions to inspect and assess. GAI tools are very effective in generating assignments and assessment tools that meet the evaluation level. The following prompt could be used by faculty or students.

**Faculty or Students.** *Compare and contrast data visualization techniques and summarize the strengths and weaknesses of each.*

The sixth level is creating. This level intends to rearrange parts into a new assembly or shape through forming, arranging, planning, or constructing. The following prompt could be used by faculty or students.

**Faculty or Students.** *Use a marketing data set to create a marketing plan.*

Pedagogical innovation is feasible through the use of GAI tools. Faculty can experiment with these tools to make their presentations more effective and robust by incorporating better images and graphics as well as audio and video presentations of content. This will make the course content more suitable for a diverse set of learning styles.

To reduce time spent on repetitive tasks such as grading, assessments can be automated to allow more time for critical thinking skills development and increasing interactions with the learners as well as interactions among the learners. There are specific tools for this purpose that are described in the next section. The process of providing feedback can be augmented with the use of GAI-related tools so that learners can be given access to the adaptive learning systems (Kabudi, et al., 2021, Wang, et al., 2023, Imhof et al., 2020). These systems provide personalized instruction making teaching and learning more effective.

Similarly, learning analytics dashboards (Verbert, et al., 2020, Jivet, et al., 2018, and Matcha, et al., 2018) can be used to better understand and improve the learning process. These systems help visualizing data about learners and facilitate personalized instruction, providing better feedback to stakeholders so that they can adjust teaching and learning to

improve the overall learning processes.

Another area that GAI-based platforms and technologies can help is to reduce or eliminate the learning equity gap that currently exists among different learners based on demographics. Creating and using intelligent tutoring systems (Alam, 2023; Lin et al., 2023; and Wang et al., 2023) for various subjects could help achieving this significant and impactful goal.

### **3. Examples of GAI-based Platforms in Teaching and Learning**

Several platforms have been developed to facilitate teaching, learning, and to increase students' engagement. These tools have been developed for use at various educational levels. The followings are some examples.

- Top Hat (<https://tophat.com>) creates questions and pools to engage students among other capabilities. The first level of Bloom's taxonomy is remembering. Increasing engagement of students with the course contents, with other learners, and the course instructor facilitates the ability of learners to more deeply focus and absorb the subject's contents. The additional conversations and engagement help learners to more deeply dive into the course contents.
- Kritik <https://www.kritik.io> allows students to evaluate other students' assignments and provide them feedback. To be able to provide meaningful feedback, learners need to comprehend the subject and hence meet the understand level of the Bloom's taxonomy. Since they have to provide feedback for their peers, they need the ability to evaluate other students' responses hence the platforms support the evaluate level of the Bloom's taxonomy. Each learner needs to prepare and post their assignments for their peers' evaluation so the platform helps the create level of Bloom's taxonomy. This platform increases students' interaction, engagement, and critical thinking. It also increases their experience with the course content.
- Packback <https://www.packback.co> increases students' engagement, allows real-time feedback, and serves as a grading assistant for faculty members. The platform facilitates more meaningful interaction with students and less time on tasks such as grading hence it supports the understanding level of Bloom's taxonomy.
- Noddle Factory <https://www.noodlefactory.ai> allows educators and learners to personalize learning by creating customized tutorials that fit the learners' needs. This helps learners for the understanding level of the Bloom's taxonomy. The platform also helps in grading and enhances the learners' engagement.
- Pear Deck <https://www.peardeck.com> is a very fast content generation tool geared towards K-12 students. Its gamification approach, in particular, is suitable for the lower age group learners. It is also a relatively flexible platform that educators can use to make it more suitable for their own pedagogy and the learners' learning preferences.

### **4. GAI-Related Training for Faculty and Students**

The first step for faculty and students' use of GAI in teaching and learning is to make sure they follow the established rules and requirements set by their institution. The following is some examples of rules or guidelines institutions may want to establish.

- Only ethical uses of the GAI platforms by faculty, students, and staff are acceptable.
- Emphasis should be placed on using GAI technology to minimize educational equity gaps.
- The use of GAI platforms by faculty and staff is not mandatory and will vary significantly in different disciplines.
- The uses of GAI platforms are effective in some areas but potentially ineffective in some other areas.
- This technology should only be used to enhance teaching, learning, student engagement, or related tasks and not as

a replacement for faculty and staff.

- The users of GAI need to carefully review the content generated by these platforms for potential errors and even harmful contents including biased content generated by these platforms.
- Every faculty, student, and staff who wishes to have access to this technology should be able to do so.
- Students with limited financial resources should have equitable access.
- GAI platforms should never be used to violate the privacy of any student, faculty, and staff.
- The use of GAI by faculty and staff in teaching and learning needs to focus on reducing and eliminating repetitive tasks so that faculty and staff can focus on using these tools to create more engaging effective and personalized instructional contents.
- Faculty, students, and staff who may use these platforms in their scholarship process or teaching and learning should be very transparent and articulate their use and why they are used and properly cite any contents used.
- It is critical that institutions of higher education as well as individual faculty members articulate acceptable use policy and adopt new integrity policies clearly identifying what is and is not allowed by students regarding the use of GAI in their courses.
- Students need to make sure that the use of GAI platforms is allowed in their courses and should make sure not to violate any plagiarism rules.
- Students should carefully evaluate the accuracy of GAI generated output.
- Appropriate training and access for all faculty, students, and staff who wish to ethically use these technologies should be provided.

Given the fact that GAI-tools are now available for students to use, it is essential for faculty to adjust their courses assignments and assessment practices. In some courses, it may be required to conduct in-person testing and assessment without allowing access to GAI-tools. Another reality is that essay writing assignments may not be a good way to assess students' knowledge. Perhaps, it could be replaced with an oral presentation or real-time live discussion sessions. Faculty focus needs to be in career readiness of students. Knowing that the knowledge and skill sets related to AI are relevant in almost all careers, the focus needs to be placed on what AI-related knowledge and skill sets students need to have related to their respective discipline.

With the wide-spread use of GAI tools by faculty and students, AI and, in particular, GAI literacy (Lintner, 2024) has become essential. Yee et al., (2023) identify seven AI-related literacy modules for educators as follows: knowing how AI works, determining when to use and not to use AI, appreciating the value of AI, be knowledgeable about prompt engineering methods and effectively use prompts, properly evaluating AI generated output, incorporating human value to the outputs, and demonstrating digital malleability.

Knowing how AI works require some understanding of the Large Language Models (LLMs) which is a subset of Machine learning. Some of the current GAI-related platforms that use LLMs generate hallucination related output so it is critical that users properly evaluate output from these platforms. As newer methods and technologies will develop it is likely that the hallucination problem will be eliminated or at least been significantly reduced.

An example of where individuals can use GAI is for ideation with appropriate human input and proper safeguards regarding validity of the outputs. One obvious area that GAI should not be used is in scholarship by simply taking the output and presenting it as one's scholarship, creative work, or as a response to an assignment. One approach for documenting where GAI is applicable is to develop case studies on GAI use and its impact on teaching and learning.

To effectively use GAI in teaching and learning users need to not only be aware of the capabilities of this transformative technology but also value its applications. This is consistent with the Bloom's taxonomy we discussed in section two. Faculty can experiment with using GAI and not doing so in the same class for different lectures and measure the effectiveness of the experimental treatments.

Given that communication with GAI-based platforms is mainly by submitting a prompt, users need to have sufficient background on prompt engineering. A well written prompt helps get better results focusing on the capabilities of LLMs but also in relevant cases for generating useful images. More advanced prompts and prompt optimization techniques (Sabbatella et al., 2024; Tolzin et al., 2024; Memmert et al., 2024) could be used for better results.

Some GAI-based platforms, in particular, earlier versions, are known to produce outputs based on hallucination. It is essential to carefully review and evaluate the GAI generated output to verify its accuracy. Newer generation of GAI-based platforms could potentially be based on Explainable AI (XAI), (Altukhi & Pradhan, 2024; Mohit et al., 2024; Vatn & Mikalef, 2024) to help in this regard.

As it is expected with transformative technologies such as electricity, the Internet, and the Web, GAI is also already impacting many jobs and will continue to do so. The current and future workforce including our students need not only be familiar with GAI-related technologies but also be able to add human value to the platforms output. Our courses and instruction need to incorporate human value creation and critical thinking addition to any discussion related to GAI and related generated output.

Since the inception of first GAI tool, this technology has evolved and will continue to do so. As a result, users need to be ready and adopt current and future development. Simply said, it is like the idea of life-time learning. We need to educate ourselves and students not only to embrace but also to continue familiarize ourselves with the newer version of this technology and its evolution.

## **5. Summary and Conclusion**

In spite of the potential negative impact such as the risk of hallucination driven contents and not focusing adequately on critical thinking skill development and possible plagiarism issues, we cannot and should not ignore many positive impacts that GAI technologies may have in teaching and learning. By adopting appropriate policies and adequate training these technologies can make significant contributions to eliminating or at least reducing the demographic educational equality gap that currently exists in many communities. The GAI and related technologies are fast evolving. Newer versions of the platforms that potentially can be based on XAI can help reducing or eliminating the hallucination driven output.

## **6. Overview of the Content of this Issue**

In this issue, Vlad Krotov, in a timely article, discusses ways that the massive amount of available qualitative data can be organized for research and analysis. A case study is presented as how the proposed concept can be applied to a large amount of data for research and analysis.

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