Roadmap for Generative Models Redefining Learning in Egyptian Higher Education

Laila Mohamed ElFangary
Professor of Information Systems, Faculty of Computers and Artificial Intelligence,
Helwan University, School of Business and Finance,
NewGiza University, Cairo, Egypt

***Abstract*—Artificial Intelligence (AI) Generative models have become powerful tools in all sciences, research, academia, and businesses. Egyptian Universities need to leverage those models while using them ethically and responsibly to survive in the current global market. This paper explains the evolution of those models, from basic natural language processing by IBM in 1954 to the current powerful revolutionary generative models. The paper presents research that helps us get desired outputs or behaviors from generative models through prompt engineering, chain of thought prompting and ReAct. The paper presents Egypt and Egyptian Universities readiness and steps taken to get advantage of the latest AI technologies. The paper examines the training of those models to identify their advantages and disadvantages for university members focusing on the Egyptian context. The roadmap for Egyptian Universities use of generative models consists of a SWOT analysis; an infographic of policies and guidelines with regard to faculty and students use of generative models at Egyptian Universities promoting academic integrity and innovation, while minimizing the risks associated with this technology; A table of types and severities of penalties for policy violations by students using generative models is specified and finally a framework for nontechnical users of generative models of reusable patterns to get the optimal desired output of the models is developed.**

Keywords*—Artificial intelligence; generative models; prompt engineering; higher education; Egyptian universities

I. Introduction

This paper aims to provide a comprehensive framework for the use of generative models in Egyptian Universities. Generative Models are the current revolutionary artificial intelligence (AI) applications that act as our reliable, adjustable, and expert assistant in any research or learning process. Chatbots have automated and personalized services and processes across different industries. Generative models redefined our learning, instead of just using search engines like Google to access information now. We can use conversational engines like Google Bard or Microsoft Bing to not only get the list of sources but also get from it the relevant data presented and analyzed in the format we want. A review of universities adopting generative models and how those models evolved, highlighting their current rapid and revolutionary development is presented. Research on generative models' optimal use and Egypt readiness is examined to develop a roadmap for Egyptian Universities use of generative models.

II. Literature Review

A. Universities Adopting Generative Models

Egypt did not make generative models like ChatGPT officially accessible until November 2023 even though ChatGPT was officially introduced to the public in November 2022 [1]. As a result, Egyptian universities are lagging in the use of generative models. A recent study aiming at understanding how universities establish policies regarding the use of AI tools and exploring factors that influence their decisions analyzed top 500 universities according to the 2022 Quacquarelli Symonds (QS) World University Rankings. The study revealed that less than one-third of the universities had implemented ChatGPT policies. The use of generative models like ChatGPT in learning and teaching represented approximately 67.4% of universities, more than twice the number of universities that banned it. The study revealed that there are significant variations of university policies [2]. Generative AI is changing creative work as it can produce new content based on existing data, on creative work and workers. AI can augment human creativity, enhance productivity, and foster innovation through widely available online applications such as ChatGPT, Dall-E, and Midjourney. Today managers and leaders must leverage generative AI for their organizations and teams [3].

Harvard University, a leader and early adopter of generative AI explained, early in 2023 on its website, the concepts, and applications of generative AI and how it can create new content based on existing data. The web page provides guidelines for the responsible and ethical use of artificial intelligence at Harvard University. It covers topics such as data privacy, security, transparency, accountability, and fairness. It also provides examples of how AI can be used to advance research, education, and innovation at Harvard. The web page provides the vision and mission of the AI at Harvard program, which aims to foster collaboration and innovation in AI across the university. AI leaders and partners at Harvard can post their research on generative models. Through its website it showcases AI projects and research conducted by Harvard faculty and students, as well as AI tools and platforms available for the Harvard community. It provides resources and events related to AI education and innovation [4]. Generative models, despite their sophistication, have several limitations, GPT models still grapple with issues such as data biases leading to "hallucinations" or inaccurate outputs [5]. Birmingham University explained generative AI, how it can be

used for teaching and learning, the benefits, and challenges of using it. It provided examples of generative AI tools and projects, as well as resources and guidance for educators and students [6]. Imperial College provided guidance for instructors and students on the use of generative AI tools, such as ChatGPT, for academic work. It explained the benefits and risks of using these tools, the ethical and academic implications, and the best practices for citation and acknowledgement [7].

B. Generative Models Evolution

Early developments that lead to current generative models started since 1954, with IBM and Georgetown University laying the background for natural language processing (NLP) through automating language translation [8]. In 1966 MIT researcher Joseph Weizenbaum created ELIZA, the chatbot that used pattern recognition and predefined rules to simulate human conversation, marking the beginning of NLP research [9]. In 1983, The Boltzmann machine modeled the probability of the entire network being in a certain state, where neurons influence each other bidirectionally and the strength of these connections is represented by weights, which are learned during training. The evolution of generative models from Boltzmann machines in 1983 to Transformers represent a series of breakthroughs in machine learning which include Deep Belief Networks (DBN) and Restricted Boltzmann machine (RBM) the neural network architectures used for feature learning, classification, and generative models [10].

In the 1990s, the advancements in machine learning took place as deep learning employed neural networks for data processing enabling the development of increasingly sophisticated language models. In 1997, Long Short-Term Memory (LSTM) networks enabled the development of deeper neural networks capable of handling larger datasets [11]. Since 2010 there was dramatic transformation of NLP, as in 2010 Stanford's Core NLP suite provided algorithms for complex NLP tasks such as sentiment analysis and named entity recognition [12]. In 2011, Google Brain a deep learning artificial intelligence research team of Google AI, applied advanced resources and features like word embeddings allowing NLP systems to better understand the context of words [13].

In 2013, Diederik P. Kingma and Max Welling introduced the artificial neural network architecture Variational Autoencoders (VAE). VAE generates data by learning an approximation of the data's distribution, as the autoencoder has an encoder that maps input data to a lower-dimensional representation, and a decoder that reconstructs the original data from this representation [14]. Generative Adversarial Networks (GAN) developed by Ian Goodfellow and his colleagues in June 2014, enabled the creation of diverse and high-quality data samples that overcame initial training challenges and simplified the process of data representation and generation. GANs consist of two neural networks; the generator produces data samples from random noise, attempting to mimic the distribution of real data, while the discriminator tries to distinguish between real and generated data [15]. GANs enabled the creation of diverse and high-quality data samples. These early developments set the stage for the Transformer model, which has shown remarkable proficiency in tasks like text classification and sentiment analysis.

In 2015, Elon Musk and others endowed one billion dollars for the establishment of Open AI as a nonprofit organization to prepare against the unintended action of robotics and AI [16]. The aim was to have safe artificial general intelligence (AGI) as stated in Open AI mission: "Our mission is to ensure that artificial general intelligence—AI systems that are generally smarter than humans—benefits all of humanity" [17]. The introduction of Transformer models in 2017 revolutionized NLP. This architecture, trained on huge amounts of data, is a Large Language Models (LLM) that understands context and generates human-like text. The Generative Pre-Trained Transformer (GPT), GPT-1 introduced by Open AI in 2018, is a conversational LLM that has progressively increased in size and complexity. Elon Musk left Open AI board in 2018 and cut off funding as he criticized OpenAI's partnership with Microsoft and was working on his own AI chatbot, TruthGPT. Microsoft invested $11 billion in OpenAI since 2019 and has exclusive access to its technology as it benefits from using OpenAI's AI services in its products and platforms [18]. Since 2019, Microsoft's cloud service Azure served as OpenAI's exclusive provider of cloud computing services.

Generative AI has evolved rapidly since the release of ChatGPT in November 2022, research reveals that it could annually add to the global economy up to $4.4 trillion as it affects different industries, functions, and tasks, with marketing and sales, software development, and knowledge work.[19] In 2022, text-to-image models like Stable Diffusion, Midjourney and Dall-E generated images from textual descriptions. Dall-E uses Transformer architecture, the backbone of today's NLP models, it is based on Contrastive Language–Image Pretraining (CLIP)'s ability to relate text to images, a neural network model developed by OpenAI, designed to understand, and link images with textual descriptions [20].

Open AI released ChatGPT to the public in November 2022, other companies released new iterations of generative AI on weekly basis. OpenAI's ChatGPT, powered by GPT 3.5 an improved version of its 2020 GPT3 release, became the first widely used text-generating product, gaining a record one hundred million users in two months, making it the fastest-growing application at the time. As ChatGPT provided human-like conversations with users Microsoft integrated it with Bing search. During December LLM like Cohere supported more than one hundred languages, making it available on its enterprise AI platform and Google's Med-PaLM trained for specific use cases and domains, such as clinical knowledge. During February Amazon's Multimodal-CoT model incorporated chain-of thought (CoT) prompting, in which the model explains its reasoning, and outperforms GPT3.5 on several benchmarks; Meta's LLaMA (Large Language Model Meta AI) became more efficient to use than some other models and Microsoft introduced Kosmos-1, a multimodal LLM that can respond to image and audio prompts in addition to natural language.

In March 2023 alone, there were six major steps forward, as Salesforce announced Einstein GPT, leveraging OpenAI's models, the first generative AI technology for customer relationship management; OpenAI released GPT4, which offers significant improvements in accuracy and hallucinations mitigation, claiming 40% improvement versus GPT3.5; Anthropic introduced Claude, an AI assistant trained using a method called constitutional AI, which aims to reduce the likelihood of harmful outputs; Microsoft announced the integration of GPT4 into its Office 365 suite, potentially enabling broad productivity increases; Google released Bard, an AI chatbot based on the Language Model for Dialogue Applications (LaMDA) family of LLMs; Bloomberg announced an LLM trained on financial data to support natural language tasks in the financial industry. While in April Amazon announced Bedrock, the first fully managed service that makes models available via API from multiple providers in addition to Amazon's own Titan LLM [21].

Chatbot AI the promising and disruptive technology automated and personalized various services and processes across different industries making major technology companies compete in the chatbot market, such as META, Anthropic, Deepmind, and Microsoft [22]. Currently Microsoft announced a new multiyear, multibillion-dollar investment with OpenAI, which is the third phase of partnership, following Microsoft's previous investments in 2019 and 2021, the renewed partnership is seen to accelerate breakthroughs in AI and help both companies engage in supercomputing at scale and commercialize advanced technologies in the future [23]. As of December 2023, ChatGPT has over 180 million users. Chat.openai.com website has around 1.7 billion visits per month [24]. OpenAI Chat GPT expects $200 million in revenues and $1 billion by 2024 [25].

C. Optimizing Generative Model Performance

Prompts are the way of communication with currently popular AI applications based on LLM's like ChatGPT. The quality of outputs from a conversational LLM is due to the quality of the prompts. Prompt patterns systematically guide LLMs enhancing interaction and task automation, providing a reusable solution framework to recurring problems. They provide a structured approach to customizing LLM output and interactions. Prompt Engineering is the art of crafting effective prompts to guide the responses of a machine learning model to achieve desired outputs or behaviors. Prompt engineering is a key strategy for enhancing the effectiveness and efficiency of generative models. Studies related to how best users of the models can craft their prompts classified prompt patterns into input semantics, output customization, error identification, prompt improvement, interaction, and context control [26].

Other research examining language models, including GPT-3 by OpenAI and LaMDA by Google, revealed that standard prompting is not always effective for reasoning tasks but Chain-of-thought prompting where generative models' users give an input, a series of reasoning steps, and an output, proved superior to standard prompting especially in arithmetic, commonsense, and symbolic reasoning. Users provide a step-by-step example of the way to solve a specific problem and the model follows the same sequence. This revealed the capabilities of generative models as it can learn from few natural language examples rather than relying solely on extensive training datasets. Chain-of-thought prompting enabled LLM's detail their reasoning before delivering an answer as users presented it with examples of such reasoning, making it generate its' own chains of thought. It got the model to break down multi-step problems, allowing for detailed reasoning, offering insight into the model's thinking, and facilitating debugging and understanding [27].

Other studies introduced ReAct methodology for the generative models to solve tasks by making language models both "think" (reason) and "do" (act). The models can interact with external information sources, like searching on the internet, and then adjust their reasoning based on what they find. As a generative model is capable of reasoning and acting, it does not just pull information; it thinks about what information to pull next, making its decision-making more dynamic. This method enabled the models to make plans, think of innovative ideas, and change their plans if something new comes up, it is like playing a game where it constantly must decide what to do next. ReAct Compared to other methods gave better results at answering questions, checking if facts are true navigating websites. When compared to other ways of teaching AIs, ReAct was better as the model learns with using few examples helping it make better decisions as it thinks through the problem [28].

D. Egypt's Preparedness for Generative Model Integration

Egypt readiness for generative models is clear in its national AI Strategy, which presents a comprehensive plan for integrating Artificial Intelligence (AI) into various sectors in Egypt, including education and university research. The strategy emphasizes the importance of building human capacity in AI, promoting AI research, and encouraging the integration of AI in university curricula and research projects. This is clear in its vision: "Exploit AI technologies to help achieve Egypt's development goals for the benefit of all Egyptians, and to promote Egypt's regional leading role to be an active global player in AI." Further to achieve its mission: "Create an AI Industry in Egypt, including the development of skills, technology, ecosystem, infrastructure and governance mechanisms to ensure its sustainability and competitiveness" [29]. It highlights the establishment of AI faculties in universities and the development of AI-related educational programs. A priority sector of Egypt AI strategy is Natural Language Processing (NLP) reflecting a strong commitment to integrating generative models and AI technologies in the educational sector. Egypt is producing the "Egyptian Charter on Responsible AI," which is based on the OECD AI Principles. This charter aims to include assessment guidelines, technical guidelines, and best practices for entities utilizing AI systems including universities [30].

Egypt developed various programs and collaboration among government agencies, private sector, and civil society to safeguard Egypt's ICT infrastructure and promote a secure digital environment [31]. Egypt Social Responsibility Strategy focuses on integrating technology in various social sectors including education [32]. Law No. 151 of the year 2020 provides a legal framework for the protection of personal data in Egypt as it establishes guidelines and regulations for electronic processing and control as well as penalties for

violations of the law. [33] As the law outlines protection of personal data, and cross-border data transfer rules, it confirms with data subject rights regarding entering sensitive or confidential data into publicly available AI tools to protect privacy and conform to institutional information security policies. Egyptian Universities adhere to data privacy regulations and ensure the secure storage and handling of data this includes data used for training and deploying generative models.

Egypt has been a leader in educating its youth in the field of Artificial Intelligence as it established since 1996, the current Faculties of Computers and Artificial Intelligence to better reflect its educational mission and research focus. Those faculties support national educational objectives that include a strong emphasis on enhancing educational quality and integrating modern technology processes [34]. Egyptian Universities are working closely with government bodies and industry leaders to develop policies and guidelines for AI use in education and research. With regards to AI applications, Egyptian Universities established partnerships with tech companies specializing in AI and generative models to facilitate the exchange of knowledge and resources. One Example is Dell Technologies that has launched an initiative in collaboration with the Ministry of Communications and Information Technology (MCIT) to provide AI training in five Egyptian universities. This included workshops for university professors and students in AI and its applications, such as data science and big data engineering. Participating universities included Cairo University, Ain Shams University, the Arab Academy for Science and Technology, the American University in Cairo, and the German University in Cairo [35]. MCIT and The Egyptian Universities Network for Artificial Intelligence (EUNAI) a consortium of Egyptian universities work collaboratively on AI research and education offering resources and training programs related to generative models 36].

III. Pros and Cons of Generative Models in Egyptian Higher Education

In developing policies and guidelines for the use of generative models, Egyptian Universities should recognize that these engines are essential in teaching and research as they will change the way students learning and practice of humanities and Sciences, offering new products and services. Generative models redefined students learning process as they interact with the models to conduct conversational research to brainstorm summarize and analyze any topics of interest, they can understand new concepts by interactive simulations and games, and they can get advice on any issue [37]. Yet the model can create deepfakes, it may support events or hypothesis that are false and become convincing deceiving people. Students may copy the content in assignments without proper citation will result in the spread of cheating and plagiarism. Students should properly cite the use of AI tools using proper citation format adopted by most academic style guides [38], [39], [40]. Further studies have revealed that AI detection tools are still not reliable, several academic institutions do not recommend using the available automatic detection applications for academic integrity violations using generative AI, given their unreliability and inability to provide definitive evidence of violations [41]. OpenAI withdrew its detection software due to the software's unreliability [42]. Criteria for approval to use generative models in assignments included academic justification, scope of use, source and type of generative model, data sensitivity and ethical implications, citation and transparency, review and approval process [43],[44],[45],[46]. Top universities presented types and severities of penalties for violations by students using generative models [47], [48].

There are disadvantages specific to Egypt and Egyptian Arabic speaking public universities context, as 59% of websites are in English and only 9% are in Arabic [49]. The results of an analysis of top ten million websites revealed that 60.4 % were in English and 1.1% was in Arabic. Yet from the years 2001 till 2011, the rate of online growth of the Arabic language use increased by 2,501% while it increased by 281% for English language [50]. Hyperscale data centers, which are ones with over 5,000 servers, are around six hundred in the world. Around 39% of them are in the US, while China, Japan, UK, Germany, and Australia account for about 30% of the total. This leaves the rest of the world 31% [51]. The share of internet users as a percentage of the population globally is 63%. In the developed world population, it is 90% while in the developing world it is 57% [52] [53]. Today's popular generative large language models were trained on internet data these include AI applications developed by OpenAI the GPT-3,[54] DALL-E,[55][56] and Google BERT [57][58]. As Generative models were trained on internet data that is mostly in English presenting the English-speaking population, developed countries point of view. The model may generate content that does not confirm with the culture of the Arab world, it might produce biased information intentionally or unintentionally which may harm faculty members or students. The teaching in Egyptian public universities is in Arabic [59] with which the models may generate text but certainly it is not the language that it had much of its training in.

IV. Roadmap for Egyptian Universities use of Generative Models

The roadmap for Egyptian Universities use of generative models consists of a SWOT analysis; An infographic of policies and guidelines with regard to faculty and students use of generative models at Egyptian Universities promoting academic integrity and innovation, while minimizing the risks associated with this technology; a table of types and severities of penalties for policy violations by students using generative models is specified and finally a framework for nontechnical users of generative models of reusable patterns to get the optimal desired output of the models is developed.

A. SWOT Analysis of Egyptian Universities

The following is strengths, weaknesses, opportunities, and threats (SWOT) analysis on the use of Generative Models for Egyptian Universities that aides the development of a policy compatible with Egyptian laws, Artificial Intelligence strategy, cultural and social context. Table I is a SWOT analysis revealing the potential benefits of using generative models in education and research and the potential risks associated with the use of this technology, such as plagiarism and cheating.

TABLE I. SWOT ANALYSIS

Strengths	Weaknesses
-Conversational research, brainstorming, summarization, and analysis on any topic -Create interactive simulations and games that help learn and understand any concept -Provide consulting services	-Present biased content -Generate plagiarized content -Used in cheating -Create deepfakes that can be used to deceive people -Create harmful content
Opportunities	**Threats**
-Revolutionize the way Science and humanities taught and practiced. -Make better decisions in projects and research -Create products and services	-Generate reports against cultural and social context of Egyptians -AI detection applications may result in false negatives or positives -Spread of misinformation and harm of entities

B. Policy Initiatives for Egyptian Universities

The following is a suggested policy initiative to ensure that the use of generative models at Egyptian Universities is to promote academic integrity and innovation, while minimizing the risks associated with this technology. The National Council of Artificial Intelligence may collaborate with existing academic integrity committees in public universities and with faculty members to extend the responsibilities of the existing Academic Integrity Committee to review reports of academic misconduct involving generative models. The committee should be responsible for generative model risk assessment evaluating the ethical implications of their use in academic activities.

Based on Egypt AI strategy and aligned with the Universities Organization Law and its executive regulations Universities and Faculties should include the suggested policy statement: In accordance with Egypt AI strategy and The Universities Organization Law and its executive regulations, students must uphold academic integrity while also leveraging the potential of Artificial Intelligence (AI), including Generative Models, for academic endeavors. Use of AI is subject to faculty and instructors' approval. Acceptable uses of AI include idea brainstorming, initial draft creation, and language enhancement. The University prohibits the use of AI-generated content without proper citation or to complete assessments designed to evaluate individual skills. AI detection tools and human judgment may be employed to scrutinize submissions for AI-generated plagiarism. Faculty may require an oral examination to validate a student's understanding of any AI-assisted submissions.

1) Faculty guidelines: For University Faculty, Fig. 1 titled Faculty Guidelines for Integrating Generative Models into Coursework provides step-by-step guidelines. Changes in assignment design, submission protocols and grading rubric should take place to integrate the use of generative models. Faculty should review assessment methods to enable the development of AI resistant assignments and use oral examinations when possible. The Syllabus should include acceptable use that faculty will discuss in classes.

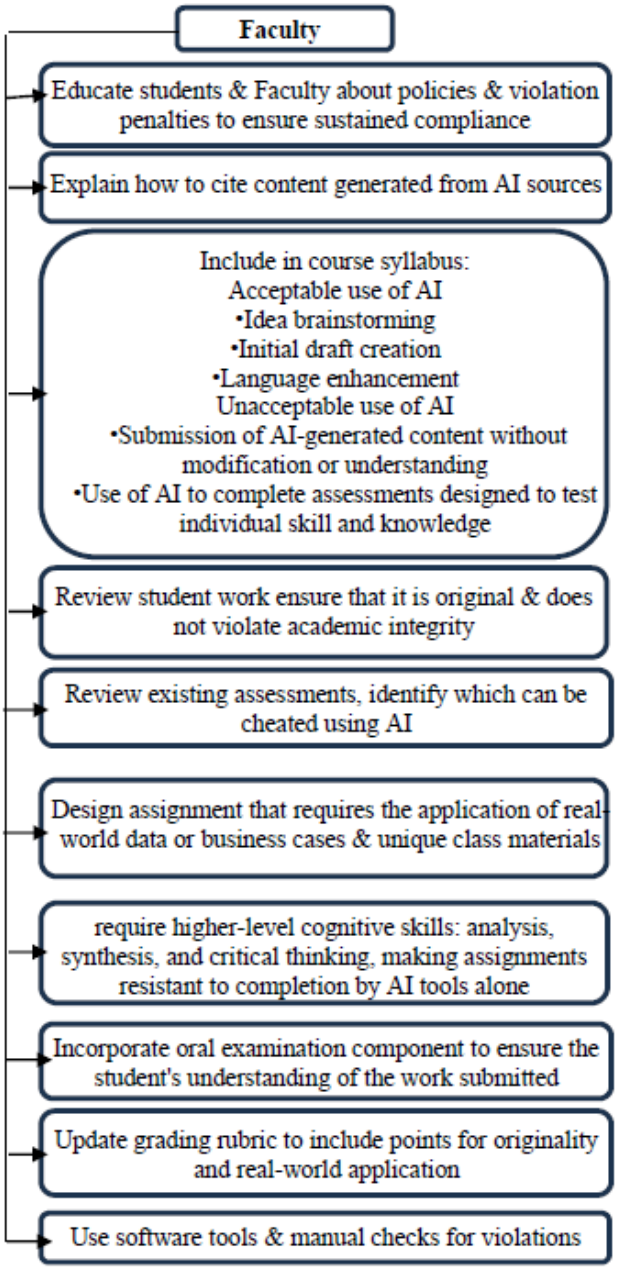

Fig. 1. Faculty guidelines for integrating generative models into coursework.

2) Student guidelines: Student Guidelines for Effective Use of Generative Models in Courses. Fig. 2 include preliminary approval for the use of generative models, responsible use of AI and disclosure of their use. Students can use AI as a tool for data collection, brainstorming and Language enhancement enabling them to be creative and produce their own original work. Faculty should review the request based on these criteria and provide a decision within a reasonable period.

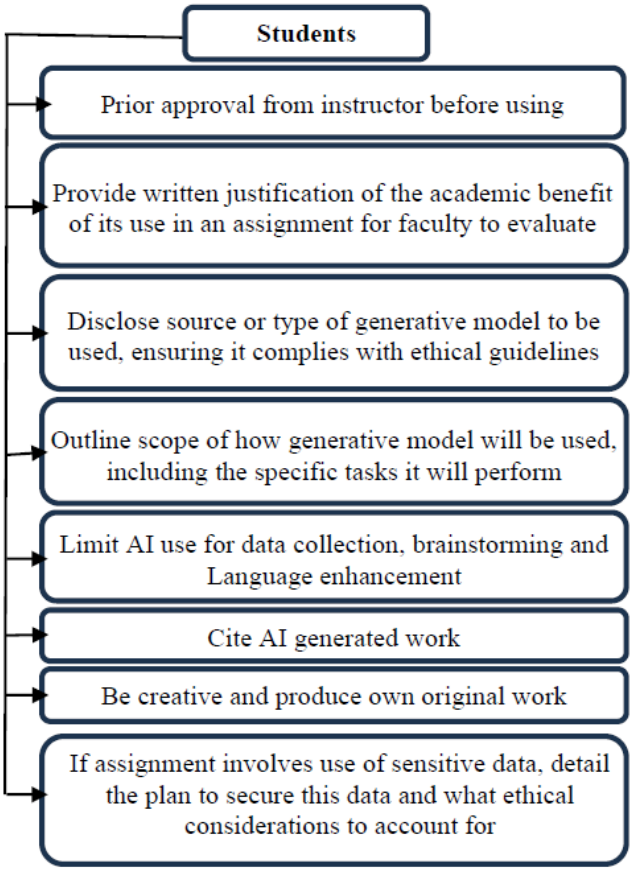

Fig. 2. Student Guidelines for effective use of generative models in courses.

V. Penalties for Student Policy Violations

Penalties for misuse of generative models that fit the Egyptian Universities context include an academic integrity committee to investigate suspected AI-assisted cheating, apply penalties, and regularly review criteria for generative models use with the Egyptian national AI Committee. The academic integrity Committee should decide on the penalty depending on the infraction level ranging from minor, moderate, major to severe, and whether it is a first-time offense or more. Further students that feel that the review committee unfairly penalized them should file an appeal within fourteen days of the committee's decision. The following Table II provides examples of infraction severity and type of penalties applied depending on the number of times the students did the violation.

TABLE II. Penalties for Student Policy Violations

Severity / Type of Use	**Offense**		
	First	***Second***	***Third***
Minor: Unauthorized for non-graded class activities, not citing the use of a generative model in a homework assignment	Warning, requirement to attend integrity workshop	20% Deduction of assignment points	Failing grade for the assignment
Moderate: Unauthorized in graded homework assignments, group projects	50% Deduction of assignment points	Failing grade for assignment .	Failing the course
Major: To complete exams, final projects, or thesis work; instances of unauthorized use across several courses	Failing the course and academic probation	Mandatory integrity counseling	Expulsion from the university
Severe: To produce work that is published as original research without citation, plagiarizing on a scale that affects the university reputation	Possible legal action, expulsion from university	Students may file an appeal with the Academic Integrity Committee within 14 days of receiving penalty notice.	

VI. Framework for Optimal Generative Model Output

To get the best out of those models, Egyptian University members whether faculty, students, or administration should build their skills regarding prompt Engineering. Fig. 3 is an infographic for nontechnical users of generative models based on ChatGPT as it has the fastest growing number of users. In my proposed framework users should put in mind that it is useful to interpret the input, for example, when I entered in my prompt course syllabus, I identified that whenever I refer to "course code" it should refer to this course syllabus. It was further useful when identifying the use of common abbreviations instead of repeating the detail in each prompt of the conversation. Persona tailors the model response, for example respond as an information System professor, and further specify the audience as it differs in output sophistication for elementary school students or PhD Students in the field. Today's models can generate code to execute any instructions, create visualization images and graphs to whatever topics discussed through text to image instructions.

Generative models can, if given the steps show alternative results or asked for the steps of a certain result and use templates to generate output in specific structure. To avoid and check for errors the model can identify inaccuracies in its output and create a list of facts that need validation. If it refuses to answer a question the question can be sub divided or rephrased. Further the model can switch roles with the user as it gathers through questions all the data from the user necessary for it to generate the output. The User may present any rules and the model can participate in any game presenting simulations and automating its output. Once the user refers to key aspects in a conversation the model can maintain context, it can provide step by step explanations given a certain input and output showing how to arrive at the desired result using users' resources. The model can reason as it accesses external information whether available over the internet or given to it by the user as attachments and based on this information it will adjust its output. Once you provide an example of how a process should be, it will follow the same process on different data.

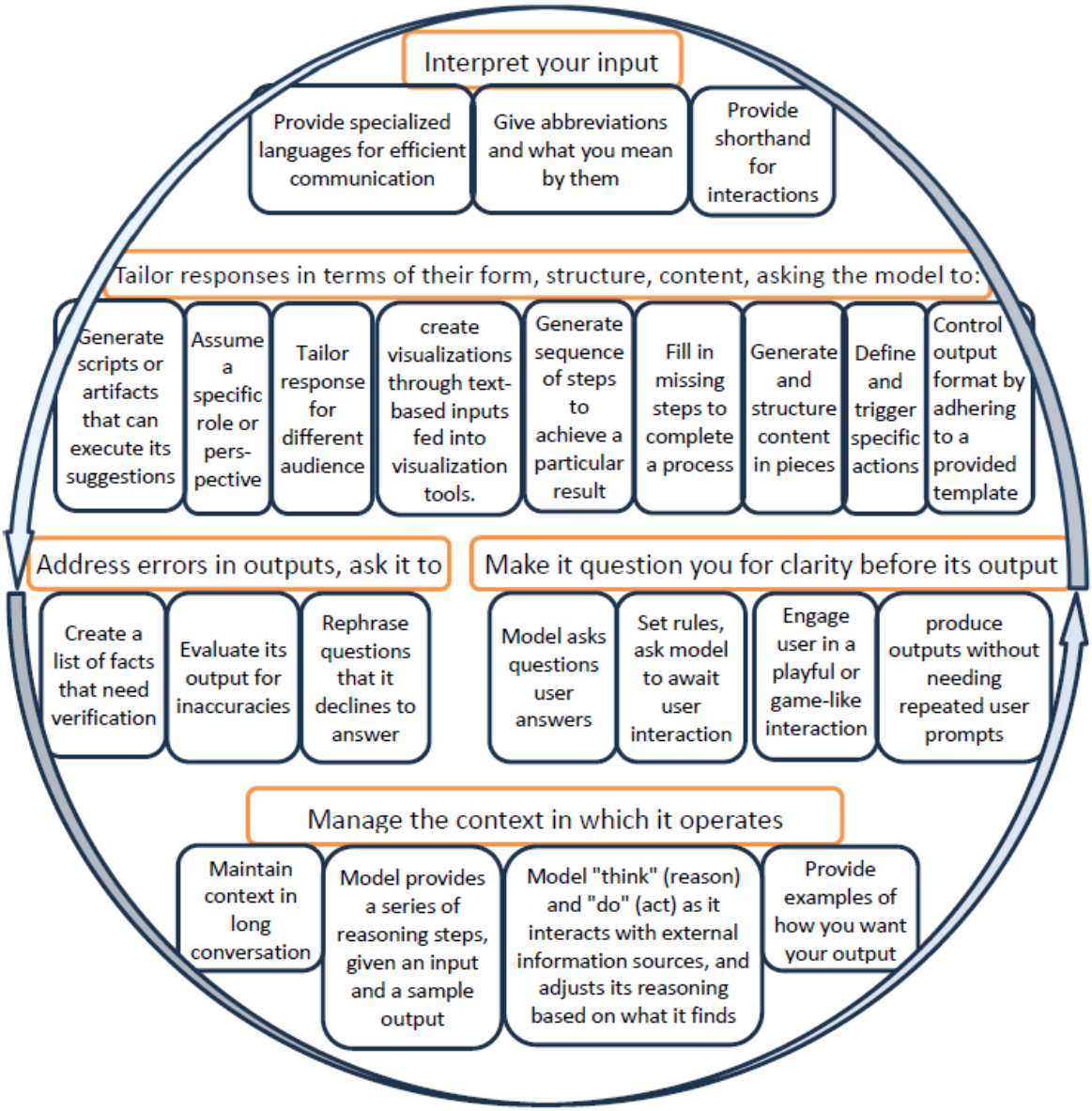

Fig. 3. Generative model communication framework.

VII. Conclusion

In conclusion, this paper provides a comprehensive framework for the use of generative models for Arabic speaking, developing countries focusing on Egyptian Universities. A roadmap for the use of generative models in redefining the learning is developed. The research presented SWOT analysis on the use of Generative Models for Egyptian Universities where general factors applicable to all academia worldwide and other factors specific to Egypt were analyzed. Further, a policy that is compatible with Egypt laws, initiative, and cultural and social context was developed. This included key aspects of step-by-step guide for faculty inclusion of generative models in curriculum and students use of the models, in addition to a matrix of types and severities of penalties for policy violations by students using the models. This paper proposed an infographic of patterns that work for non-specialized students to get the best out of the generative models' capabilities. The framework is a reference for current generative models' capabilities in communicating with users. Finally, Universities should adjust their policies based on an ongoing monitoring of the actual use of generative models.

VIII. Future Work

Potential directions for further research could include cross-cultural comparative studies as Egyptian universities and universities from different regions with diverse cultural and legal frameworks could be compared to provide insights into how generative models are adapted globally. To fine-tune policies and educational strategies over time, longitudinal studies may be conducted to assess the impact of implementing generative models in the curriculum on students' learning outcomes, faculty teaching methods, and overall academic

integrity. Universities should increase adoption and effective use of AI through working on technology acceptance modeling to understand faculty and students' attitudes towards generative models and factors influencing acceptance and resistance of generative models.

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