Use of AI-Based GPTs in Experimental, Empirical, and Exploratory Research Methods

P. S. Aithal [1] & Shubhrajyotsna Aithal [2]

[1] Faculty, Institute of Management & Commerce, Srinivas University, Mangalore, India, OrcidID: 0000-0002-4691-8736; E-mail: psaithal@gmail.com

[2] Faculty, Institute of Engineering & Technology, Srinivas University, Mangalore, India, OrcidID: 0000-0003-1081-5820; E-mail: shubhraaithal@gmail.com

Area of the Paper: Technology Management
Type of the Paper: Exploratory Research.
Type of Review: Peer Reviewed as per |C|O|P|E| guidance.
Indexed In: OpenAIRE.
DOI: https://doi.org/10.5281/zenodo.8407794
Google Scholar Citation: IJCSBE

How to Cite this Paper:
Aithal, P. S., & Aithal, S., (2023). Use of AI-Based GPTs in Experimental, Empirical, and Exploratory Research Methods. *International Journal of Case Studies in Business, IT, and Education (IJCSBE), 7*(4), 33-47. DOI: https://doi.org/10.5281/zenodo.8407794

International Journal of Case Studies in Business, IT and Education (IJCSBE)
A Refereed International Journal of Srinivas University, India.

Crossref DOI: https://doi.org/10.47992/IJCSBE.2581.6942.0308

Paper Submission: 15/07/2023
Paper Publication: 06/10/2023

International Journal of Case Studies in Business, IT, and Education (IJCSBE), ISSN: 2581-6942, Vol. 7, No. 4, October 2023

SRINIVAS PUBLICATION

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P. S. Aithal [1] & Shubhrajyotsna Aithal [2]

[1] Faculty, Institute of Management & Commerce, Srinivas University, Mangalore, India, OrcidID: 0000-0002-4691-8736; E-mail: psaithal@gmail.com

[2] Faculty, Institute of Engineering & Technology, Srinivas University, Mangalore, India, OrcidID: 0000-0003-1081-5820; E-mail: shubhraaithal@gmail.com

ABSTRACT

Purpose: *Academic research is a systematic study based on the creation of new knowledge or new interpretations of existing knowledge. As per one school of studies, academic research uses three generic methods known as experimental research, empirical research, and exploratory research. The use of recently developed AI-based GPTs have shown their ability to provide information from global sources without directly copying from any one source. Thus, it is an interesting research problem on how AI-based GPTs can be used in all three types of research methods.*

Methodology: *This is conceptual research and makes use of the information obtained from various sources like scholarly articles, AI-based GPTs to know the use of AI-based GTPs at various stages of experimental research, empirical research, and exploratory research methods.*

Results/Analysis: *The paper analysed and evaluated how the AI-based GPTs help the researchers at various stages of experimental research, empirical research, and exploratory research by supporting the researchers to apply various higher-level research skills including design, analysis, comparison, evaluation, interpretation, and creation of new knowledge.*

Originality/Value: *The paper discusses how recently invented artificial intelligence engines like GPTs help researchers to improve the value of their research outcomes.*

Type of Research: *Conceptual research.*

Keywords: Artificial Intelligence technology, GPTs, Research methods, Experimental research method, Empirical research method, Exploratory research method

1. INTRODUCTION :

The realm of academic research is a dynamic and multifaceted landscape, characterized by a myriad of research methods and approaches tailored to different objectives and inquiries. Among these, three foundational pillars stand tall in shaping the foundation of scholarly investigation: Experimental Research, Empirical Research, and Exploratory Research (Aithal, P. S. et al. (2023). [1]). These distinct methodologies serve as the compass, map, and magnifying glass, respectively, guiding researchers on their quest for knowledge, understanding, and insight. Experimental research, anchored in the pursuit of causality, meticulously manipulates variables within controlled environments to unearth cause-and-effect relationships. Empirical research, on the other hand, relies on the systematic collection and analysis of observable data to inform evidence-based conclusions (Patten, M. L. (2016). [2]). Lastly, exploratory research embarks on journeys of discovery into the unknown, illuminating the uncharted territories of human understanding (Swedberg, R. (2020). [3]). Together, these research methods represent the diverse spectrum of tools available to scholars, each offering its unique strengths, applications, and contributions to the tapestry of human knowledge. In this exploration, we embark on a comprehensive journey through these three research methodologies, uncovering their definitions, types, procedures, precautions, and above all, their pivotal roles in advancing understanding and fostering innovation in an ever-evolving academic landscape.

In the digital age, the synergy between artificial intelligence (AI) and academic research has ushered in a new era of scholarly exploration and discovery (Burger, B., et al. (2023). [4]). At the forefront of this transformative union stands AI-based Generative Pre-trained Transformers, or GPTs, which have

emerged as remarkably versatile tools capable of assisting researchers across the entire spectrum of research methods. Be it in the controlled laboratories of experimental research, the data-driven terrain of empirical inquiry, or the uncharted territories of exploratory investigation, AI-based GPTs have transcended the boundaries of traditional research, offering unprecedented capabilities in literature review, hypothesis generation, data collection design, analysis, and report writing (Firat, M. (2023). [5]). As these AI marvels harness the power of natural language understanding and generation, they empower researchers to navigate the complexities of their chosen methodologies with enhanced efficiency, creativity, and precision (Aithal, S., et al. (2023) [6]). However, as with any revolutionary tool, the integration of AI-based GPTs in research methods raises crucial questions regarding ethical considerations, potential biases, and the dynamic interplay between human ingenuity and machine assistance (Esplugas, M. (2023). [7]). In this exploration, we embark on a comprehensive journey through the myriad ways in which AI-based GPTs are reshaping and augmenting experimental, empirical, and exploratory research, illuminating their profound impact on the pursuit of knowledge and innovation in the modern academic landscape (Rana, S. (2023). [8]). In this paper, the use of AI-Based GPTs like Chat GPT and Bart for various stages of Experimental, empirical, and exploratory research.

2. RESEARCH METHODS AS PER THE GENERAL SCHOOL OF THOUGHT :

In the vast realm of academia and scientific inquiry, the selection of an appropriate research method is akin to choosing the compass that guides explorers through uncharted territories. Each research method within the General School of Thought serves as a unique navigational tool, offering distinct advantages and applications, while also shaping the trajectory of investigations in various disciplines [9]. In this comprehensive exploration, we delve into three foundational research methods that underpin the very fabric of knowledge generation and inquiry: the Experimental Research Method, the Empirical Research Method, and the Exploratory Research Method [10].

The Experimental Research Method, often regarded as the gold standard of scientific inquiry, provides a structured framework for investigating causal relationships. By meticulously manipulating variables and applying controlled conditions, researchers can unearth cause-and-effect relationships that lie at the heart of understanding complex phenomena. In this method, controlled experiments offer a controlled environment, where hypotheses are tested, and results are statistically analyzed [11]. The Experimental Research Method is a cornerstone of disciplines such as psychology, physics, and medicine, allowing researchers to isolate and examine specific factors that influence outcomes.

On the other hand, the Empirical Research Method is a broader approach that focuses on gathering observable and measurable data, often through systematic observation or surveys [12-13]. It involves collecting empirical evidence, which is based on real-world observations, measurements, and experiences. Empirical research aims to provide a comprehensive understanding of phenomena by relying on data and evidence rather than theoretical conjecture. This method is extensively employed in social sciences, economics, and the natural sciences, offering insights into real-world problems and informing evidence-based decision-making. In contrast, the Exploratory Research Method is the pioneer of research, venturing into the unknown and embracing the uncertain [14]. It is an essential preliminary step in the research process, particularly when little is known about a topic or when the subject matter is too complex to be captured by other research methods. Exploratory research seeks to gain insights, generate hypotheses, and define research questions by immersing researchers in the subject matter [15-16]. It often employs qualitative methods such as interviews, focus groups, or content analysis to explore the depths of a topic before embarking on more extensive studies. This method is especially valuable in fields like sociology, anthropology, and market research, where understanding the nuances of human behavior and culture is paramount. As we embark on this journey through the rich tapestry of research methods, it becomes evident that each method in the General School of Thought brings a unique set of tools and perspectives to the table. These methods are not mutually exclusive but rather complementary, often interwoven in the research process. Researchers adept at navigating this diverse terrain can harness the power of experimental precision, empirical rigor, and exploratory curiosity to push the boundaries of knowledge, fostering innovation and discovery across a multitude of disciplines.

2.1 Experimental Method:

Experimental research methods are a cornerstone of scientific inquiry, designed to investigate causal relationships between variables through systematic manipulation and controlled conditions. This research approach is characterized by its rigor, objectivity, and the ability to establish cause-and-effect connections. Below, we provide a detailed description of experimental research methods, including definitions, types, procedures, precautions, and their importance.

(1) Definition:

Experimental research is a quantitative research method that involves manipulating one or more independent variables to observe their impact on a dependent variable while controlling extraneous factors. It aims to establish a causal relationship between variables, offering insights into the fundamental workings of the natural and social world.

(2) Types of Experimental Research:

(i) Laboratory Experiments: These experiments are conducted in controlled environments, such as a laboratory, where researchers can precisely manipulate variables. They offer a high level of control but may lack real-world context.

(ii) Field Experiments: Conducted in natural settings, field experiments maintain external validity by studying variables in their real-life context. However, researchers have less control over extraneous factors.

(iii) Quasi-Experiments: In cases where random assignment is not feasible, quasi-experiments are employed. They involve naturally occurring groups and are used when ethical or practical constraints limit randomization.

(iv) True Experiments: True experiments involve random assignment of participants to experimental and control groups, ensuring that the treatment is the only difference between the groups. They are the gold standard for causal inference.

(3) Procedures:

(i) Identification of Variables: Researchers identify the independent variable(s), which they manipulate, and the dependent variable(s), which they measure.

(ii) Random Assignment: In true experiments, participants are randomly assigned to experimental and control groups.

(iii) Experimental Manipulation: The independent variable is manipulated systematically to observe its effect on the dependent variable.

(iv) Data Collection: Data is collected through measurements and observations of the dependent variable.

(v) Statistical Analysis: Researchers use statistical tests to analyze the data and determine whether the independent variable had a significant effect on the dependent variable.

(4) Precautions:

(i) Randomization: Ensure proper randomization to eliminate bias and increase the internal validity of the study.

(ii) Control Groups: Include control groups to compare the effects of the independent variable accurately.

(iii) Ethical Considerations: Adhere to ethical guidelines, including obtaining informed consent and minimizing harm to participants.

(iv) Minimize Extraneous Variables: Control or measure extraneous variables that could confound the results.

(v) Sample Size: Ensure an adequate sample size to achieve statistical power and generalize findings.

(5) Importance:

(i) Causal Inference: Experimental research is the gold standard for establishing cause-and-effect relationships, which are fundamental to scientific understanding.

(ii) Precision: It allows for precise control of variables, reducing the likelihood of alternative explanations for observed effects.

(iii) Objectivity: The systematic nature of experiments minimizes bias and subjectivity in data collection and analysis.

(iv) Scientific Progress: Experimental research drives scientific progress by testing hypotheses and theories, leading to new discoveries.

(v) Applied Research: It informs real-world applications, from medical treatments to marketing strategies, by demonstrating the effectiveness of interventions.

In summary, experimental research methods are a robust and essential approach for advancing knowledge and understanding causal relationships across various disciplines. By adhering to rigorous procedures and precautions, experimental research enables researchers to explore the intricacies of the natural and social world, fostering scientific progress and practical applications.

2.2 Empirical Method:

Empirical research methods form the backbone of scientific investigation, emphasizing the collection and analysis of observable data to answer research questions or test hypotheses. This research approach is characterized by its reliance on evidence derived from real-world observations and measurements. Here, we provide a detailed description of empirical research methods, including definitions, types, procedures, precautions, and their importance.

(1) Definition:

Empirical research is a quantitative or qualitative research method that relies on the systematic collection and analysis of empirical evidence, which includes observable data, facts, and experiences. It seeks to draw conclusions or make inferences based on this evidence, often through structured research designs.

(2) Types of Empirical Research:

(i) Descriptive Research: Descriptive studies aim to depict the characteristics or attributes of a phenomenon without manipulating variables. Common methods include surveys, case studies, and content analysis.

(ii) Correlational Research: Correlational studies investigate the relationships between two or more variables. They assess the degree and direction of association between variables but do not establish causation.

(3) Procedures:

(i) Formulate Research Questions: Researchers begin by formulating clear research questions or hypotheses.

(ii) Data Collection: Data is collected through various means, including surveys, observations, experiments, interviews, or content analysis.

(iii) Data Analysis: Collected data is analyzed using statistical or qualitative methods, depending on the research design.

(iv) Interpretation: Researchers interpret the results to draw conclusions, make inferences, or test hypotheses.

(v) Report Findings: Findings are communicated through research papers, reports, presentations, or other appropriate formats.

(4) Precautions:

(i) Research Ethics: Adhere to ethical guidelines, ensuring informed consent, privacy protection, and minimization of harm to participants.

(ii) Sampling: Select a representative sample to enhance the external validity of the findings.

(iii) Instrument Validity and Reliability: Use valid and reliable measurement tools to ensure the accuracy of data collection.

(iv) Control for Confounding Variables: In correlational and experimental research, control or account for confounding variables that might affect the results.

(v) Data Quality: Ensure data quality through rigorous data collection and analysis procedures.

(5) Importance:

(i) Evidence-Based Decision-Making: Empirical research provides the foundation for evidence-based decision-making in various fields, including healthcare, education, and policy.

(ii) Understanding Complex Phenomena: It helps in unraveling the complexities of natural and social phenomena by collecting and analyzing real-world data.

(iii) Hypothesis Testing: Empirical research rigorously tests hypotheses and theories, either confirming or refuting them, leading to scientific progress.

(iv) Predictive Modeling: Empirical data can be used to develop predictive models and inform future outcomes and trends.

(v) Policy Development: Policymakers rely on empirical research findings to formulate and evaluate policies, ensuring they are effective and evidence-based.

In summary, empirical research methods are indispensable for advancing knowledge and understanding the world around us. By adhering to established procedures and precautions, empirical research allows researchers to collect, analyze, and interpret data systematically, contributing to scientific progress, evidence-based decision-making, and the advancement of various fields of study.

2.3 Exploratory Method:

Exploratory research methods are a crucial part of the scientific inquiry process, serving as the initial step in investigating new or poorly understood phenomena. These methods focus on gaining insights, generating hypotheses, and understanding the nature of a topic or problem. A detailed description of exploratory research methods, including definitions, types, procedures, precautions, and their importance is provided below:

(1) Definition:

Exploratory research is a qualitative research method that aims to explore a subject or phenomenon, often when little is known about it, to gain a deeper understanding. It is characterized by its open-ended nature and the absence of preconceived hypotheses, allowing researchers to discover new aspects or questions related to the topic.

(2) Types of Exploratory Research:

(i) Literature Review: Examining existing literature and research on the subject to identify gaps, trends, and areas requiring further investigation.

(ii) Qualitative Research: Conducting in-depth interviews, focus groups, or content analysis to gather rich, unstructured data and insights.

(iii) Case Studies: Intensive examinations of specific cases, often providing detailed insights into a unique or complex phenomenon.

(iv) Observational Studies: Observing and recording behaviors or events in natural settings to understand underlying patterns or factors.

(v) Pilot Studies: Small-scale investigations to test research methods and gather preliminary data before a larger study.

(3) Procedures:

(i) Define the Research Problem: Clearly state the problem or topic of interest, highlighting what is currently unknown or unclear.

(ii) Data Collection: Use appropriate methods (e.g., interviews, observations, surveys) to collect data, often focusing on open-ended questions.

(iii) Data Analysis: Analyze collected data to identify patterns, themes, or emerging insights.

(iv) Interpretation: Interpret findings to generate hypotheses, refine research questions, or develop a more structured research design.

(v) Report Findings: Summarize the exploratory research process, findings, and any insights gained.

(4) Precautions:

(i) Researcher Bias: Be aware of and mitigate potential researcher bias that may influence data collection and interpretation.

(ii) Data Validity: Ensure the validity of qualitative data by triangulating findings through multiple data sources or methods.

(iii) Sampling: Select participants or cases that represent diverse perspectives and experiences related to the research problem.

(iv) Ethical Considerations: Adhere to ethical guidelines, including obtaining informed consent and protecting the confidentiality of participants.

(5) Importance:

(i) Problem Identification: Exploratory research helps identify and define research problems, particularly in areas with limited prior research.

(ii) Hypothesis Generation: It lays the foundation for hypothesis generation and the formulation of specific research questions.

(iii) In-Depth Understanding: Exploratory methods provide in-depth insights and context, enabling researchers to develop a more comprehensive understanding of complex phenomena.

(iv) Research Design Refinement: Findings from exploratory research often inform the design of subsequent studies, ensuring they target relevant variables and questions.
(v) Decision-Making Support: Businesses, policymakers, and organizations use exploratory research to inform decisions and strategies when dealing with new or emerging issues.
In summary, exploratory research methods play a pivotal role in the research process by opening doors to uncharted territory. They enable researchers to uncover hidden aspects of phenomena, generate hypotheses, and refine research questions. By adhering to appropriate precautions and procedures, exploratory research provides a vital starting point for further investigation, hypothesis testing, and the expansion of knowledge in various fields.

3. OBJECTIVES OF THE PAPER :

(1) To analyse and evaluate three generic research methods commonly used in academic research.
(2) To compare the generic research methods in terms of their applicability and importance.
(3) To evaluate and interpret the use of AI-based GPTs in experimental, empirical, and exploratory research methods.
(4) To suggest the strategies to be used while using AI-based GPTs in academic research.
(5) To provide postulates and corresponding suggestions to use AI-based GPTs in academic research.

4. METHODOLOGY :

The research methodology typically used in this conceptual research paper involves literature review, identification of research gap, information collection using, Google search engine, Google scholar search engine, and AI-based GPTs, various analysis procedures and frameworks to develop new concepts, frameworks, and postulates which do not need further proof. The propositions are statements or assertions derived from the newly developed or refined theory or framework. These postulates may serve as the foundation for future empirical research.

5. USE OF AI-BASED GPTS IN EXPERIMENTAL RESEARCH :

The use of AI-based Generative Pre-trained Transformers (GPTs) in experimental research has become increasingly prevalent in recent years, revolutionizing the way researchers approach and conduct experiments across various domains. GPTs, such as OpenAI's GPT-3 and its successors, are powerful natural language processing models that can generate human-like text based on the input they receive [17-20]. Table 1 depicts a detailed explanation of how AI-based GPTs are utilized in experimental research:

Table 1: Details of how AI-based GPTs are utilized in experimental research

S. No.	Key Stages	Description
1	Literature Review and Hypothesis Generation	(i) Automated Literature Review: GPTs can assist researchers in conducting automated literature reviews by summarizing, categorizing, and identifying key trends and findings within a vast body of existing research. This helps in identifying gaps, inconsistencies, and areas for further investigation. (ii) Hypothesis Generation: GPTs can generate hypotheses based on the information extracted from the literature review. Researchers can input specific research questions or keywords, and GPTs can generate potential hypotheses, which can then be refined and evaluated.
2	Experimental Design and Variable Identification	(i) Experimental Variables: GPTs can assist in identifying relevant independent and dependent variables, suggesting potential confounding variables, and helping researchers structure their experimental designs.

		(ii) Sample Size Calculation: GPTs can aid in determining the appropriate sample size based on statistical considerations and expected effect sizes, facilitating the planning phase of experiments.
3	Data Collection and Survey Design	(i) Survey Generation: GPTs can help create survey questions and response options that are clear, unbiased, and designed to elicit meaningful responses from participants. (ii) Data Preprocessing: GPTs can automate the initial steps of data preprocessing by extracting and organizing textual data from sources such as surveys, interviews, or social media.
4	Data Analysis and Interpretation	(i) Statistical Analysis Assistance: GPTs can provide guidance on the selection of appropriate statistical tests and help researchers interpret statistical outputs. (ii) Qualitative Data Analysis: For qualitative studies, GPTs can assist in coding and categorizing textual data, identifying themes, and generating summaries.
5	Report and Paper Writing	(i) Automated Drafting: GPTs can generate initial drafts of research papers, summarizing key findings, discussing implications, and even suggesting appropriate citations. (ii) Language Polishing: GPTs can assist in proofreading, grammar checking, and improving the overall readability of research papers.
6	Natural Language Processing (NLP) Experiments	(i) Sentiment Analysis: Researchers can use GPTs for sentiment analysis of textual data, helping to assess the emotional tone or polarity of written content in experiments. (ii) Text Classification: GPTs can be employed for text classification tasks, such as categorizing survey responses or identifying specific textual patterns.
7	Decision Support	(i) Recommendation Systems: GPTs can provide recommendations for research methodologies, data collection tools, and data analysis techniques based on specific research questions and objectives.
8	Ethical Considerations	(i) Bias Mitigation: Researchers should be aware of potential biases in AI-generated content and take steps to mitigate them, ensuring fairness and ethical conduct in experimental research.

Incorporating AI-based GPTs into experimental research can enhance efficiency, creativity, and the quality of research processes. However, it's essential for researchers to exercise caution, critically evaluate AI-generated content, and maintain a balance between automation and human expertise. GPTs should be considered valuable tools that complement researchers' skills and domain knowledge, ultimately contributing to more robust and insightful experimental research.

6. USE OF AI-BASED GPTS IN EMPIRICAL RESEARCH :

The use of AI-based Generative Pre-trained Transformers (GPTs) in empirical research has gained considerable attention and utility across various fields. These advanced natural language processing models, like GPT-3 and its successors, have the potential to streamline and enhance different stages of empirical research. Table 2 depicts a detailed explanation of how AI-based GPTs are employed in empirical research:

Table 2: Details of how AI-based GPTs are utilized in empirical research

S. No.	Key Stages	Description
1	Literature Review and Hypothesis Formulation	(i) Automated Literature Summaries: GPTs can assist researchers by summarizing and synthesizing vast amounts of literature

		quickly and efficiently. They can provide concise summaries of existing research, highlighting key findings, trends, and knowledge gaps. (ii) Hypothesis Generation: Based on the insights gained from the literature review, GPTs can help researchers generate hypotheses for empirical testing, suggesting potential relationships between variables or predicting outcomes.
2	Survey and Questionnaire Development	(i) Questionnaire Generation: GPTs can assist in designing surveys and questionnaires, helping researchers formulate clear and unbiased questions. They can also suggest appropriate response options and scales. (i) Pilot Testing: Researchers can use GPTs to generate pilot surveys for initial testing and refinement before deploying them to the actual research participants.
3	Data Collection and Analysis	(i) Data Preprocessing: GPTs can aid in the initial steps of data preprocessing by extracting and organizing textual data from surveys, interviews, or open-ended responses. (ii) Qualitative Data Analysis: For studies involving qualitative data, GPTs can help with coding and categorizing textual data, identifying themes, and generating summaries. (iii) Sentiment Analysis: Researchers can employ GPTs for sentiment analysis of textual data to assess the emotional tone or polarity of responses in their empirical studies.
4	Report Writing and Manuscript Preparation	(i) Automated Drafting: GPTs can assist researchers in generating initial drafts of research reports, summarizing key findings, discussing implications, and even suggesting relevant citations. (ii) Proofreading and Editing: GPTs can help improve the quality of research papers by offering language polishing, grammar checking, and readability enhancement.
5	Data Visualization	(i) Chart and Graph Generation: GPTs can assist in creating data visualizations like charts and graphs to represent empirical findings more effectively.
6	Experiment Design	(i) Empirical Variables: GPTs can help identify and define independent and dependent variables and suggest potential confounding variables, assisting researchers in designing empirical.
7	Decision Support	(i) Methodological Guidance: GPTs can provide recommendations for research methodologies, data collection tools, and statistical analysis techniques based on specific research questions and objectives.
8	Ethical Considerations	(i) Bias Mitigation: Researchers must be aware of potential biases in AI-generated content and take measures to mitigate them, ensuring the ethical conduct of empirical research.

The integration of AI-based GPTs in empirical research offers researchers valuable tools to enhance the efficiency and rigor of their studies. However, it's essential to use these tools judiciously, maintaining a balance between automation and human expertise. Researchers should critically evaluate AI-generated content and take ultimate responsibility for the design, execution, and interpretation of empirical research to ensure its validity and reliability. GPTs serve as valuable complements to researchers' skills and knowledge, contributing to more robust and insightful empirical research outcomes.

7. USE OF AI-BASED GPTS IN EXPLORATORY RESEARCH :

The use of AI-based Generative Pre-trained Transformers (GPTs) in exploratory research is an innovative approach that can significantly enhance the initial stages of inquiry when researchers seek to gain insights, generate hypotheses, and explore uncharted territory [21-30]. Table 3 depicts a detailed explanation of how AI-based GPTs can be effectively employed in exploratory research:

Table 3: Details of how AI-based GPTs are utilized in empirical research

S. No.	Key Stages	Description
1	Literature Review and Hypothesis Generation	(i) Automated Literature Summaries: GPTs can quickly review and summarize large bodies of literature related to the research topic. They can identify key concepts, trends, and knowledge gaps, providing a starting point for exploratory research. (ii) Hypothesis and Research Question Generation: GPTs can assist researchers in formulating research questions and generating initial hypotheses based on the information extracted from the literature review.
2	Idea Generation and Problem Framing	(i) Brainstorming and Idea Generation: GPTs can be used to generate creative ideas or potential research directions, especially when researchers are exploring novel or multidisciplinary areas. (ii) Problem Framing: Researchers can use GPTs to refine the scope of their exploratory research by defining research problems more clearly.
3	Survey and Data Collection Design	(i) Questionnaire and Survey Development: GPTs can aid in designing surveys or interview protocols by suggesting questions, prompts, or areas of inquiry for data collection during the exploratory phase. (ii) Data Collection Methodologies: GPTs can provide recommendations for data collection methods, such as interviews, focus groups, or content analysis, depending on the research context.
4	Data Analysis and Sense-Making	(i) Textual Data Analysis: For exploratory research involving textual data, GPTs can assist in processing, coding, and categorizing data. They can identify recurring themes, patterns, or relationships within the data. (ii) Sentiment Analysis: GPTs can be employed for sentiment analysis to understand the emotional tone or opinions expressed in textual data.
5	Report and Findings Synthesis	(i) Automated Reporting: GPTs can help in generating preliminary reports or summaries of exploratory findings, making sense of the collected data, and highlighting emergent insights.
6	Ethical Considerations	(i) Ethical Guidance: GPTs can provide guidance on ethical considerations in exploratory research, ensuring that researchers address issues such as informed consent, privacy, and data security.
7	Decision Support	(i) Research Direction Recommendations: GPTs can suggest potential research directions, guiding researchers in their exploration of uncharted topics.
8	Ideation and Concept Generation	(i) Conceptual Frameworks: GPTs can assist in developing initial conceptual frameworks or models that capture the complexity of the explored phenomena.

While AI-based GPTs offer valuable support in exploratory research, researchers should exercise critical judgment, review and validate the generated content, and maintain control over the research process. GPTs can significantly enhance the efficiency and depth of exploratory research, but they

should be seen as tools that complement human expertise and creativity. Researchers should be aware of potential biases in AI-generated content and ensure that their exploratory findings are rigorously examined, validated, and interpreted within the context of their research goals.

8. STRATEGIES TO BE USED WHILE USING AI-BASED GPTS IN ACADEMIC RESEARCH:

Using AI-based GPTs in academic research, including experimental research, empirical research, and exploratory research, requires careful planning and strategic implementation. Here is a list of strategies to consider when utilizing GPTs in academic research:

Table 4: Details of how AI-based GPTs are utilized in empirical research

S. No.	Strategy	Explanation
1	Define Clear Research Objectives	Clearly articulate your research goals and objectives before using GPTs to ensure the AI aligns with your research questions.
2	Select the Right GPT Model	Choose the most appropriate GPT model based on the complexity and nature of your research, e.g., GPT-3, GPT-4, or a specialized variant.
3	Data Preparation	Ensure your input data, such as text corpus or dataset, is clean, well-structured, and relevant to your research domain
4	Preprocessing and Data Cleaning	Preprocess the data to remove noise, outliers, and irrelevant information to improve the quality of AI-generated content
5	Bias Mitigation	Be aware of potential biases in the training data and the AI model itself. Implement bias mitigation strategies to address these biases
6	Fine-Tuning	Consider fine-tuning the GPT model on domain-specific data to enhance its relevance and accuracy for your research.
7	Ethical Guidelines	Adhere to ethical guidelines when using AI, especially in sensitive research areas, to ensure responsible and ethical research practices
8	Experimental Design	Design experiments or research methodologies that leverage GPTs effectively and ethically
9	Human Oversight	Incorporate human oversight to review and validate AI-generated content, reducing the risk of misinformation or errors
10	Data Security	Protect sensitive data and ensure compliance with data security and privacy regulations when working with AI-generated content
11	Validation and Verification	Develop validation and verification procedures to assess the accuracy and reliability of AI-generated results
12	Collaboration	Collaborate with AI experts, data scientists, and domain experts to ensure the effective use of AI in your research
13	Collaboration	Collaborate with AI experts, data scientists, and domain experts to ensure the effective use of AI in your research
14	Benchmarking	Compare the performance of AI-generated content with traditional research methods to assess its advantages and limitations
15	Documentation	Document the AI model, its parameters, and the data used in your research for transparency and reproducibility
16	Experiment Reproducibility	Share code and configurations to enable other researchers to reproduce your experiments and validate your findings
17	Feedback Loop	Establish a feedback loop with the AI model, updating it as needed to improve its performance and relevance to your research
18	Continuous Learning	Stay updated with the latest developments in AI and GPT technology to leverage new capabilities in your research
19	Robustness Testing	Test the AI model's robustness by subjecting it to various scenarios and challenges that may be encountered in real-world research

20	Ethical Review	If required, seek ethical review board approval for research involving AI, especially when working with sensitive data or potential ethical concerns
21	Data Licensing	Ensure that you have the appropriate licenses and permissions to use the data in your research, especially when using copyrighted material.
22	Public Engagement	Engage with the public and stakeholders to discuss the ethical implications and potential societal impacts of AI-based research
23	Dissemination	Share your research findings and insights responsibly through peer-reviewed publications, conferences, and academic forums.
24	Long-Term Sustainability	Consider the long-term sustainability of AI-based research tools and models, including ongoing maintenance and updates.
25	Cost-Benefit Analysis	Evaluate the cost-effectiveness and benefits of using AI-based GPTs in your research compared to traditional methods.
26	SWOC/ABCD/PESTLE analysis	SWOC/ABCD/PESTLE analysis using AI-based GPTs in your research by collecting relevant information.

By implementing these strategies, researchers can harness the power of AI-based GPTs while ensuring the integrity, ethics, and effectiveness of their academic research endeavours.

9. POSTULATES & SUGGESTIONS TO USE AI-BASED GPTS IN ACADEMIC RESEARCH:

Table 5 lists some postulates and suggestions for using AI-based GPTs (Generative Pre-trained Transformers) in academic research:

Table 5: Postulates and suggestions to use AI-Based GPTs in Academic Research

S. No.	Postulates	Suggestions
1	AI-based GPTs can efficiently summarize and analyze vast bodies of literature, helping researchers identify key findings, trends, and knowledge gaps to inform their research directions.	Use GPTs to conduct automated literature reviews to save time, gain a broader perspective, and ensure a comprehensive understanding of the existing research landscape.
2	GPTs can assist researchers in generating research questions and initial hypotheses based on their input and insights.	Collaborate with AI models to brainstorm research questions and hypotheses, refining them based on AI-generated suggestions.
3	AI-based GPTs can provide recommendations for structuring surveys, interviews, or data collection methods, ensuring clarity and relevance.	Use GPTs to optimize survey questions, interview scripts, or data collection protocols for more effective and relevant data gathering.
4	GPTs can assist in analyzing textual data by identifying themes, patterns, and sentiment within the data.	Employ GPTs to conduct preliminary textual data analysis, helping to identify insights and trends before more in-depth analysis.
5	AI-based GPTs can generate initial drafts of research reports, aiding in summarizing findings and discussions.	Utilize GPTs to expedite the report-writing process while maintaining a human touch in refining and contextualizing the generated content.
6	Researchers must consider ethical implications when using AI-based GPTs, especially in sensitive research areas, to ensure data privacy and responsible AI usage.	Develop and adhere to ethical guidelines that address privacy concerns, consent, and transparency in AI-assisted research.
7	GPTs can offer recommendations and insights on research design, data collection, and analysis approaches.	Consult AI models at various stages of research to make informed decisions, benefiting from data-driven suggestions.

8	GPTs can help create data visualizations, making empirical findings more accessible and compelling.	Collaborate with AI for creating charts, graphs, and infographics that effectively communicate research outcomes.
9	AI-based GPTs can assist in developing initial conceptual frameworks or models, especially in exploratory research.	Employ AI to generate initial conceptual frameworks, which can serve as a foundation for refining theories and hypotheses.
10	Researchers should continually learn and adapt their use of AI-based GPTs as technology evolves and new capabilities emerge.	Stay updated on AI advancements and explore new applications to harness the full potential of GPTs in academic research.

By adhering to these postulates and suggestions, researchers can harness the power of AI-based GPTs to enhance the efficiency, creativity, and rigor of their academic research endeavours while ensuring ethical and responsible usage.

10. CONCLUSION :

In conclusion, the integration of AI-based Generative Pre-trained Transformers (GPTs) into experimental, empirical, and exploratory research methods marks a transformative leap in the landscape of academic inquiry. These versatile AI tools, equipped with the capacity to comprehend, generate, and analyze textual data, empower researchers with unprecedented efficiencies and capabilities. GPTs serve as invaluable companions in literature reviews, hypothesis generation, data collection design, analysis, and report writing, streamlining processes, and expanding the scope of what is achievable. However, it is imperative that researchers exercise critical judgment, ensure ethical considerations are met, and maintain a balance between automation and human expertise. AI should augment, not replace, the intellect and creativity of researchers. By judiciously employing AI-based GPTs, researchers can unlock new dimensions of knowledge, propel research frontiers, and continue to drive the pursuit of truth and innovation across diverse fields of academic inquiry.

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