

# *Utilizing Artificial Intelligence in Instigating a Research Project*

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**Abstract**— In today's world, artificial intelligence (AI) is being utilized in classroom education, transportation, computer programming, construction, space science, engineering, medical industry, and many other scientific and technological arenas. Nevertheless, AI is considered prohibited in many circumstances due to ethical concerns, trepidations of job displacement, and its portrayal in media. This combination of ethical, economic, and cultural factors drives suspicion and agitation against AI. Misuse of AI can lead to incorrect decision-making. However, instead of considering AI as proscribed, it can be utilized in research areas especially developing hypothesis and reviewing literature. To generate a theoretical or experimental research, the researchers must review a series of technical articles. It takes longer if those articles are selected and reviewed manually. With the help of generative AI, a larger number of relatable articles could be selected, and reviewed in shorter duration which could conserve time, effort, and expenditure. This study will display how to select and review number of articles in a short instance utilizing AI. Concrete is one of the widely used construction materials. But its application in complex geometric structure is challenging. The author utilized AI to pick an advanced topic on spontaneous application of concrete, to short-list some notable articles on that topic, to review those articles, and finally, to draft a presentation for her research group. Detail description has been provided in this paper how those articles were chosen and how a new handout was drafted within a day.

**Keywords**—*ChatGPT; review; research; shotcrete.*

## I. INTRODUCTION

A literature review is systematic analysis of technical papers or scholarly sources including academic journals, conference proceedings, thesis and dissertations, research proposals and scientific reports. Before starting research, development of a hypothesis is required. Reviewing numerous articles assists researchers to develop a hypothesis. AI is the replication of human intelligence in machines which assists to achieve goals related to problem-solving, and decision-making while consuming less time and effort. It influences technologies like chatbots, and autonomous vehicles. Some examples of AI software are: ChatGPT, Siri and Alexa, OpenCV, Grammarly,

and Tesla Autopilot. AI can serve as a tool to quickly review a large number of research articles.

Concrete is one of the commonly used construction materials utilized worldwide because of the availability of its ingredients and its relatively easier application. However, application of concrete in complex geometric structures, e.g., tunnels, swimming pools, retaining walls, domes, dam linings, is challenging. The author was looking for some advanced topics to initiate a civil engineering student research project on application of concrete in complex structures, which was to be started within a week. The author explored ChatGPT [1] to find some suitable topics. At first it was asked that “Can you list some techniques to apply concrete for complex structures?”. Several topics were displayed including “Shotcrete (Sprayed Concrete)”. The author then asked, “Can you describe briefly what is meant by shotcrete?”. A detail description was displayed with two different techniques of application. Shotcrete has several benefits over regular concrete includes: 1) no need of formwork 2) saving time 3) saving expenditure 4) enhancing strength and durability. The author decided to move forward with this topic and started working on the literature review.

## II. METHODOLOGY

The author asked ChatGPT “Can you list some research articles on shotcrete?”. Several papers were displayed which were published between 2015 and 2021 in various journals or conferences. Next the author’s more specific queries included “Is there any paper on shotcrete in cement concrete research?”. A number of indexed journals were displayed this time but the publication years ranged between 2009 and 2012. Afterward the author asked, “Are there any papers on shotcrete in cement concrete research published between 2015 and 2024?”, and a list of most recent papers were provided.

Next the author started reviewing a few selected articles with the help of ChatGPT. Based on one of the selected papers [2], the author asked ChatGPT “Which mechanical properties were assessed in this paper entitled Assessment of Mechanical Behavior of Sprayed Concrete Reinforced with Waste Tire Steel Fibers?”. A summary of certain mechanical properties was listed

including compressive strength, flexural strength, and modulus of elasticity, which were exactly listed in that paper and relevant mechanical properties of materials. This indicates the information provided by ChatGPT was authentic.

### A. Reviewing Single Article

One of the specific questions regarding this article was “Can you create a table showing the different mechanical properties obtained in this paper [2] for different fiber content?”. ChatGPT replied that it do not have access to the specific data from that paper. It made a random table listing effect of fiber content on mechanical properties of shotcrete. Also, it further asked the author “Would you like assistance in finding the actual paper or its specific data?”. After approval, it provided a summary on effect of fiber content on mechanical properties, particularly its deformability and energy absorption capacity and suggested an optimum percentage.

### B. Comparing Multiple Articles

To compare multiple articles, the author asked “I need a summary (table or figure) of five most recent articles on shotcrete. Do you have any questions before we move on?”. ChatGPT requested the author to indicate how the summary should be provided, whether it should be tabularized, and which properties should be compared. After providing elaborate explanation, ChatGPT provided a list as shown in Table I, citing five [3-7] research articles. It was observed that ChatGPT identified the variation in compressive strength of shotcrete in the articles by Emad et al. [3], Li et al. [4], and Tong et al. [5], while no mechanical property assessments were reported in the other two articles [6, 7].

TABLE I. SUMMARY OF FIVE RESEARCH ARTICLES ON SHOTCRETE [1]

Study Title	Authors/Source	Year	Compressive Strength	Flexural Strength	Impact Resistance	Tensile Strength	of Elasticity
Flowability and Mechanical Properties of Shotcrete Concrete Incorporated with Waste Plastic Fibers	ResearchGate	2022	Decreased with RPET fiber addition	Not specified	Not specified	Not specified	Not specified
Compressive Test Characteristics and Constitutive Relationship of Wet and Dry Shotcrete	Wiley Online Library	2021	Wet shotcrete: 30.95% higher than dry shotcrete	Not specified	Not specified	Not specified	Not specified
Study on Mechanical Properties of Basalt Fiber Shotcrete in High-Temperature Environments	PMC	2021	Increased by 10.5% at 40°C and 41.1% at 60°C	Not specified	Not specified	Not specified	Not specified
Properties of Latex-Modified Shotcrete Beneficial to Concrete Repairs	Transportation Research Board	1984	Not specified	Not specified	Not specified	Increased	Not specified
Experimental Study on Basic Mechanical Properties of Steel Fiber-Reinforced Shotcrete	Wiley Online Library	2018	Not specified	Not specified	Not specified	Not specified	Not specified

### C. Drafting Presentation

To draft a short presentation, the author typed in ChatGPT “Can you please help me to draft five slides on shotcrete based on the most recent research articles? Information could be tabularized. Otherwise, utilize charts, pictures, and bullet items.

Please let me know if you need more information before start.” It showed notes on shotcrete provided as five different slides, but no image or PowerPoint slides were provided. Next the author asked, “Can you make three PowerPoint slides summarizing shotcrete with some images?”. The search result was satisfactory. It provided three slides with images as shown in Fig. 1. This facilitated the author to quickly create her own slides utilizing the information provided in Table I and the slides shown in Fig. 1.

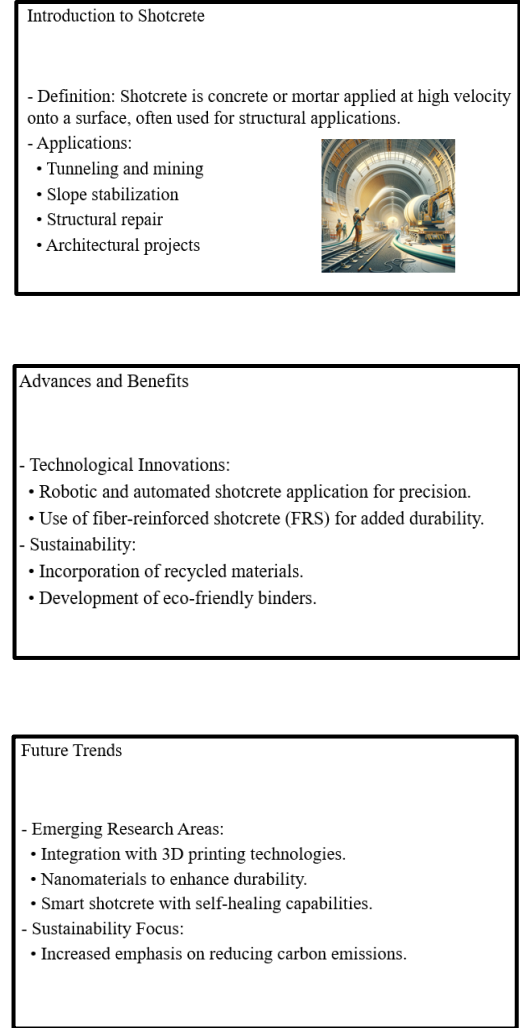


Fig. 1. Three PowerPoint slides drafted by ChatGPT [1]

## III. OUTCOMES

Using AI demands considerably less time and effort compared to manually selecting and reviewing multiple scientific articles. In many cases, research assistants are hired to spend months to review and draft articles. Limited budget of some projects often makes this recruitment challenging. By leveraging AI, researchers can reduce costs and save time, allowing them to develop hypotheses quickly and initiate projects without lengthy delays.

However, instead of most advanced and indexed articles, often AI select the random older articles with lower impact factor. During the chat, it must be mentioned which type of articles should be reviewed through comprehensive breakdown with duration of publication, title of relevant journals, or author's name. Additionally, it must be mentioned which sort of information should be reviewed and how that information should be summarized to get an intriguing result, e.g., tabular format, PowerPoint slides, figures, or document file.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

With the assistance of ChatGPT [1], a novel presentation file was drafted and presented to the research group within one day which finally helped the group to initiate tasks within a week. In this research, the author utilized free version of ChatGPT and only explored "chat" option. More options e.g., create an image, or analyze data could be explored. Additionally, an advanced version of ChatGPT (ChatGPT Plus) could be utilized to achieve better performance. Other AI tools i.e., perplexity, DeepSeek might be explored in future to attain better outcomes. Additionally, the undergraduate engineering students should be trained on how to utilize artificial intelligence prudently to draft their project reports, assignments, or presentation files.

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