

Exam Preparation with Artificial Intelligence: Examination for Building Material Course with Chat GPT

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Abstract – This paper explores the relationship between artificial intelligence (AI) and architectural education, emphasizing how Chat GPT is used in the Building Material course to help students prepare for exams. It looks into the consequences, opportunities, and restrictions of utilizing AI-powered chatbots to support architecture education by improving students' comprehension of the complex world of building materials. Two experiments for the same course were executed to explore the possibilities and problems. The ability of Chat GPT to produce practice questions gives instructors essential tools for assessing their test preparation, and their ability to get thorough course material reviews facilitates efficient revision. It can rapidly generate new responses due to given instructions; thus, an iterative process can be executed until it reaches the objectives. The use of AI in architectural education does have certain limitations in any case. Despite its informative capabilities, Chat GPT cannot offer real-time feedback, which can impede the development of critical architectural skills. It runs all responses from its training, which can be out-of-date knowledge and cannot be managed. The knowledge and experience of the user among the conservation are important to organize clear and accurate results. Ethics considerations and property rights need attention, especially concerning possible abuse and academic integrity.

Keywords – Architectural Education, Building Material, Exam Preparation, Chat GPT, Capabilities Of AI

I. INTRODUCTION

Architectural design studios are the backbone of architectural education, where students synthesize and use other courses' technical and theoretical knowledge [1]. Studios start from the first year of undergraduate education and continue until graduation. In architectural design education, students develop drawing, conceptual, and critical skills that are informed by their ability to reflect upon the production of ideas in design processes and in the urban, environmental, social, historical, constructional, and cultural contexts [2]. Thus, the curriculum that defines the other courses integrated into design studios is important to teach students the theoretical and practical aspects of architectural history, structure, urban environment, theory of architecture, and material. Some of these courses are executed with the application parts, and the rest

only consist of the theoretical parts like lectures and discussions.

Evaluating learning outcomes and students' earnings is vital for education programs. The courses of architectural education that inquire about applications generally use applications like models, project works, and juries. Generally, The teaching process in architectural education is viewed from two aspects: teaching and assessment [3]. However, for theoretical courses, conventional exams may be effectively chosen by instructors to measure the learning levels of the students. Written exams, multi-choice answered exams, and paper homework are widely used evaluation methods. This study examines the positions of artificial intelligence in building up exams for courses in architectural education. As a case study, the "Building Material" course is selected, which has been instructed for three years by the author.

Lectures and presentations issue this course, and a multi-choice exam is held. The research presents an examination with Chat GPT, a popular artificial intelligence (AI) tool, to prepare for student exams. The main objectives are to explore the possibilities and limits by implementing three experiments and discussing over results.

II. AI AND CHAT GPT

Over the past several decades, artificial intelligence (AI) has greatly impacted many industries and enterprises. It provides organized capacities for prediction, learning from differences, and reasoning based on inputs [4]. The use of and study into AI capabilities, prospects, and limitations has expanded due to the regular release of AI tools on the internet. There has been an increase in research on educational views, health, marketing, manufacturing, design, and automation [5]. Some recent studies include a thorough evaluation of the investigation of AI in higher education [6] and research demonstrating the possible application of MidJourney in architectural practice [7].

A large language model created by OpenAI called Chat GPT (Chat Generative Pre-trained Transformer) is an example of artificial intelligence that may be used as a chatbot [8]–[11]. Tuples of input and output data must be given as a sizable quantity of training data [12]. Deep language algorithms and training sets were used to construct Chat GPT, which enables conversational communication [13], [14]. It carries out a variety of activities, including question-answering, machine translation, and language modeling, which may also be used to create chatbots and virtual assistants and produce conversations that sound human [15].

After the initial release in November 2022, tests with Chat GPT are intensifying. Several working and research papers examine various themes and methodologies' potential capabilities and boundaries. Asking it to write three stories [8], asking about the best and worst US Presidents [16], and asking about the purpose of Chat GPT [10] are some examples of asking for options. The breadth, limitations, and effects of AI are other subjects that have been discussed in the literature [17], [18], as well as the potential use of Chat GPT in combating global warming [9].

III. MATERIALS AND METHOD

A set of interviews was held with Chat GPT to explore the issues on September 2023 by version 3.5. Two experiments were conducted, orderly the flow and results of the experiments are presented.

A. Experiment 1

This experiment examines Chat GPT's responses by not giving detailed instructions about the course. The question prompt is "Can you prepare a multiple-choice exam for the building material course for architecture second class?"

B. Experiment 2

This experiment examines Chat GPT's responses by giving detailed instructions about the course. The question prompt is "Can you prepare a multiple-choice exam for the building material course for architecture second class, which has a course outline:

- Introduction, Classifications
- Clay and Earth Materials
- Stone, Lime, Cement, Concrete
- Metallic Materials
- Wood, Glass
- Polymeric Materials
- Gypsum, Painting and Miscellaneous Materials

, and course objectives:

- Have knowledge about building material definition, properties and classification
- Gain ability to criticize and evaluate materials regarding usability and behaviors
- Learn various building materials and their features

and this will be final exam with 15 questions.

IV. RESULTS

The explanation of the responses of Chat GPT is presented and whole text can be found in appendices.

A. Experiment 1

There are 20 questions in the exam, which were marked as five points for each. Every question has four choices, which are one or two words. The answers are given by Chat GPT in a complete list at the end of the exam separately.

B. Experiment 2

15 questions were given as instructed. Every question has four choices; some are one or two

words, and some are almost sentences. Five points are given for each question, which ends up 75 points in total. General questions about the relation of course and architecture were added.

V. DISCUSSION AND EVALUATION

The brief results and whole exams presented in the appendices illustrate the questions of the exams due to given instructions. For experiment one, 20 exam questions with four choices were given. There are any questions and choice limits. However, AI is recommended in this way. Besides, experiment two also gave four choices for each question. It is possible to direct the Chat GPT by giving a prompt, but the first recommendation of it is noted.

The simple one-word or two-word answers can be seen by looking at the experiments' answers. The student may find the correct choices by making reasoning and evaluating differences. There are not any choices that may misdirect the students. Some choices for the questions of experiment two need more evaluation and knowledge to find the correct answers. Thus, the exam of experiment two seems more distinctive in evaluating the levels of the students' earnings.

Distribution of the questions due to subjects of the courses is important for any exam. In the first example, outline and objectives of the course were not given, so Chat GPT organized it independently. The subjects include load-bearing structure material, insulation, brick types, material features like corrosion, fire resistance and durability, sustainable materials, wood, stone, foundation, and paintings. The author evaluates the outcomes of the course instructed for three years. It is important to state that there is former work with Chat GPT for preparing course documents. The question distribution seems logical, which needs some improvement, such as steel, frame and finishing materials, purpose, and application specifications. Some questions about the structure may be omitted to gain extra slots for material-related questions. The difficulty level of the exam is found to be slightly low, which could be corrected by giving instructions.

Some instructions related to the course outline and objectives were given for experiment two. Besides, 15 questions are asked to organize. Three differences were noticed compared to experiment two. The first one is the distribution of the

questions due to the outline instructed. The second one is Chat GPT inserted some questions that seek the relation of building materials and architecture such as question one. Finally, some questions are directly related to course objectives. These are irrelevant questions for evaluating any courses. Chat GPT tried to use all prompts and instructions given to it. They can be omitted. It may be stated that the results and value of the process can be improved by executing enough cycles with Chat GPT. The important criterion is preparing clear and meaningful instructions and explanations for the interview with Chat GPT.

VI. CONCLUSION

In the age of hastily advancing generation, the fusion of Artificial Intelligence (AI) with academic practices has opened up exciting avenues for architectural education similar to all other disciplines. This article has delved into the opportunities and boundaries of utilizing Chat GPT for examination education in guides like Building Materials inside the discipline of architectural education. The objective is to explore the possibilities and limits by considering the capabilities and problems and underline some further studies.

Chat GPT emerges as a set of opportunities in education and architectural education. Its interactive nature allows customized knowledge of experiences, accommodating students' diverse wishes and alternatives. There are some advantages for exam preparation resulting from accessible knowledge, flexible learning, capability of fast generation, and comprehensive review of Chat GPT. The user could improve these capabilities by considering the interaction with correct instructions.

Some possible problems should be noted for exam preparation with Chat GPT. The works figures are general, and the user should develop it. There is no real-time feedback for the work. It is better to organize some experiments with students to evaluate the outcomes of prepared exams. The knowledge that establishes the response is originated from the training process of Chat GPT in which user or anyone can do no intervention. The final problem concerns ethical considerations and property rights of the generated responses. The research studies and works of bureaucracy continue

to build up these issues for using AI in education and whole disciplines.

These kinds of studies can be improved by further research by considering important aspects. The tuning is so beneficial for any work with AI. Thus, a framework and former preparation are needed before the execution of any interview with Chat GPT. A user without knowledge about the Building Material course instruction would miss many important criteria and aspects of the exam. The alignment of questions to learning outcomes should be sustained by ensuring the content generated by Chat GPT is congruent with the course's objectives is pivotal for effective learning.

Chat GPT presents an enticing avenue for architectural education, redefining how students engage with course materials. Although it has a bright future, caution must be used due to its restrictions and moral implications. Chat GPT can potentially become an important tool in pursuing improved architecture education experiences and learning outcomes with careful deployment and ongoing improvement.

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APPENDICES

Experiment 1

1. Which of the following materials is primarily used for load-bearing structures in construction?
 - a) Glass
 - b) Timber
 - c) Asphalt
 - d) PVC
2. Which material is known for its excellent thermal insulation properties?
 - a) Concrete
 - b) Steel
 - c) Glass
 - d) Expanded polystyrene (EPS)
3. What type of brick is commonly used for decorative purposes due to its attractive finish?
 - a) Common brick
 - b) Fire brick
 - c) Facing brick
 - d) Hollow brick
4. What is the primary ingredient in Portland cement?
 - a) Sand
 - b) Gravel

- c) Limestone
 - d) Clay
5. Which of the following metals is often used for roofing due to its corrosion resistance?
- a) Aluminum
 - b) Copper
 - c) Iron
 - d) Zinc
6. What is the primary advantage of using reinforced concrete in construction?
- a) Low cost
 - b) High strength
 - c) Easy to shape
 - d) Lightweight
7. What type of insulation material is made from fine glass fibers and is known for its fire resistance?
- a) Fiberglass
 - b) Polyurethane foam
 - c) Mineral wool
 - d) Cork
8. Which of the following is a sustainable building material made from renewable resources?
- a) Steel
 - b) Concrete
 - c) Bamboo
 - d) PVC
9. What type of wood is commonly used for interior finishing work due to its fine grain and attractive appearance?
- a) Pine
 - b) Oak
 - c) Cedar
 - d) Plywood
10. Which material is often used for waterproofing flat roofs and foundations?
- a) Asphalt shingles
 - b) Bituminous membrane
 - c) Clay tiles
 - d) Slate
11. What is the primary purpose of a vapor barrier in building construction?
- a) To provide structural support
 - b) To prevent heat loss
 - c) To control moisture penetration
 - d) To enhance aesthetics
12. What type of stone is formed from compressed layers of organic materials and is often used for countertops and flooring?
- a) Granite
 - b) Limestone
 - c) Slate
 - d) Marble
13. Which of the following is a common binder used in the production of concrete?
- a) Asphalt
 - b) Gypsum
 - c) Portland cement
 - d) Silicone
14. What material is commonly used for exterior cladding due to its durability and resistance to weathering?
- a) Vinyl

- b) Plywood
 - c) Stucco
 - d) Drywall
15. What is the primary advantage of using steel framing in construction?
- a) Low cost
 - b) High insulation
 - c) Speed of construction
 - d) Aesthetics
16. Which of the following materials is most vulnerable to termite damage?
- a) Concrete
 - b) Steel
 - c) Brick
 - d) Wood
17. What type of glass is designed to reduce heat gain in buildings by reflecting sunlight?
- a) Tinted glass
 - b) Tempered glass
 - c) Float glass
 - d) Mirrored glass
18. What is the purpose of a building's foundation?
- a) To provide structural support
 - b) To create living spaces
 - c) To improve insulation
 - d) To enhance aesthetics
19. Which material is commonly used for soundproofing interior walls and ceilings?
- a) Fiberglass insulation
 - b) Plywood
 - c) Aluminum
 - d) Masonry
20. What type of paint finish is known for its high shine and durability?
- a) Matte
 - b) Satin
 - c) Gloss
 - d) Eggshell

Experiment 2

1. What is the primary goal of studying building materials in architecture?
- a) To learn how to design buildings
 - b) To gain knowledge about construction machinery
 - c) To understand the behavior and properties of materials used in construction
 - d) To become a skilled construction worker
2. Which of the following materials is not covered in the course's classification of building materials?
- a) Clay
 - b) Metal
 - c) Plastic
 - d) Glass
3. Which course section would you expect to find information about materials like bricks and ceramics?
- a) Metallic Materials
 - b) Wood
 - c) Clay and Earth Materials
 - d) Gypsum, Painting, and Miscellaneous Materials
4. Lime is primarily used in construction for its:

- a) Structural strength
- b) Decorative qualities
- c) Adhesive properties
- d) Heat insulation

5. What is the main component of concrete that provides its strength and durability?

- a) Sand
- b) Water
- c) Cement
- d) Lime

6. Which of the following materials is an example of a metallic material commonly used in architectural applications?

- a) Glass
- b) Aluminum
- c) PVC
- d) Plywood

7. Wood is a natural building material known for its:

- a) Resistance to water and moisture
- b) High melting point
- c) Conductivity of electricity
- d) Resistance to termites

8. Which building material is transparent and often used for windows and façades?

- a) Metal
- b) Stone
- c) Wood
- d) Glass

9. Which category of building materials includes materials like plastics and rubber?

- a) Clay and Earth Materials
- b) Metallic Materials
- c) Polymeric Materials
- d) Gypsum, Painting, and Miscellaneous Materials

10. Gypsum is commonly used in construction for:

- a) Structural support
- b) Fire resistance and soundproofing
- c) Exterior cladding
- d) Plumbing systems

11. Which type of material is primarily used for providing a decorative finish to interior surfaces, such as walls and ceilings?

- a) Metal
- b) Plastic
- c) Gypsum
- d) Concrete

12. What is the primary function of a vapor barrier in construction?

- a) To provide structural support
- b) To control moisture penetration
- c) To enhance aesthetics
- d) To improve insulation

13. In the context of the course objectives, what skill should students have gained regarding building materials?

- a) The ability to design complex architectural structures
- b) The ability to critique and evaluate materials regarding usability and behaviors

c) The ability to operate construction machinery

d) The ability to write architectural research papers

14. Which course section would you expect to find information about materials like stucco and wallpaper?

- a) Stone, Lime, Cement, Concrete
- b) Gypsum, Painting, and Miscellaneous Materials
- c) Polymeric Materials
- d) Clay and Earth Materials

15. What is the primary purpose of classifying building materials in the course?

- a) To confuse students with unnecessary information
- b) To organize and categorize materials for easier study and understanding
- c) To memorize long lists of materials
- d) To promote the use of only one type of material in construction