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Exploring the Impact of Large Language Models on Building Construction Students: A Pilot Study

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Large language models (LLMs) have begun transforming multiple industries, including construction. This study explores the opportunities and challenges posed by advanced AI systems such as ChatGPT and its counterparts in the educational realm of building construction. As educators, it is crucial to understand the utilization of these AI systems by students and their impact on learning experiences. This initial study investigates the relationship between LLMs and building construction students at Auburn University. By examining the prevalence of LLM usage, primary use cases, student perceptions, and preferred platforms, we aim to gather valuable insights into the initial adoption and effects of LLMs. Our goal is to conduct a market survey to understand student experiences, attitudes, and beliefs regarding LLMs. Results indicate high adoption rates among students which highlight areas for improvement and opportunities for further research. Educational institutions, and programs like Construction Management, play a vital role in bridging knowledge gaps, addressing mistrust, and maximizing LLM benefits for academic success. Through targeted training, improved communication, and ongoing exploration, educators can ensure students fully leverage LLM capabilities to enhance their learning and professional development.

Keywords: Large Language Model (LLM), Building Construction, Student Experience, AI Tools, Construction Education

Introduction

The advent of large language models (LLMs) has initiated a paradigm shift across various industries, and the field of building construction is no exception (Abioye et al., 2021; Opoku et al., 2021). There is a need to explore the opportunities and challenges posed by advanced generative Artificial Intelligence (AI) systems, notably Chat GPT and its counterparts (Javaid et al., 2023). Educators in the discipline are witnessing the emergence of a powerful new tool that has the potential to revolutionize how students learn, collaborate, and practice their craft.

However, the integration of LLMs into the educational landscape raises important questions about their potential benefits and drawbacks (Alhafni et al., 2024). As educators in the field of building construction, it is imperative to understand how these AI systems are being utilized by students and the impact they are having on their learning experiences.

This study seeks to serve as an initial study to explore the relationship between LLMs and building construction students at Auburn University. By investigating the prevalence of LLM usage, the

primary use cases, student perceptions of their impact, and preferred LLM platforms, we seek to gain valuable insights into the initial usage of LLMs by students, allowing faculty to make informed decisions about content dissemination and assessment. Our goal is to conduct a market survey to gather insights into student experiences, attitudes, and beliefs about LLMs. This research is not intended to advocate for or against the use of LLMs but rather to provide valuable data for educators and administrators.

This research sought to initially explore four key questions:

- How prevalent is the use of LLMs among building construction students at Auburn University, and what factors influence their adoption and usage patterns?
- What are the primary use cases for LLMs among building construction students, and how do these use cases vary?
- How do building construction students perceive the impact of LLMs on their academic performance and learning experiences?
- What are the preferred LLM platforms and tools among building construction students, and how do these preferences relate to their experiences?

To answer the above questions, the researchers conducted a survey of construction management students at the McWhorter School of Building Science. By analyzing the survey data, we aim to create a benchmark that helps provide an understanding of the role of LLMs in building construction education and identify potential areas for future research and development.

Literature Review

Use of LLMs

Artificial intelligence's (AI) rapid evolution has affected the entire world in the last few years. AI is a technology that imitates human behavior such as learning, reasoning, and predicting by utilizing a system or machine (Xu et al., 2021). With the release of AI chatbots, people have started to utilize these tools in almost every area, including manufacturing, business, education, and even daily chores. A chatbot is a computerized program that simulates conversations as an intermediary between humans and virtual assistants (Gupta et al., 2020). These AI tools, such as ChatGPT, Microsoft's CoPilot, Google's Bard (now Google Gemini), merge Large Language Models (LLMs) with user-friendly interfaces (Teubner et al., 2023).

While LLMs offer significant benefits, their use also raises important concerns. On the positive side, LLMs can improve efficiency, productivity, and access to information (Choi & Schwarcz, 2023; Noy & Zhang, 2023). They can automate tasks, provide personalized recommendation, and facilitate learning. Additionally, LLMs can be used to develop new applications and services that were previously infeasible (Bouschery et al., 2023). However, there are also multiple concerns about the potential negative consequences of LLMs (Achintalwar et al., 2024). A major concern is the risk of bias in LLM outputs, as they are trained on text datasets that may reflect real-world biases, leading to discriminatory results. Another concern is the potential for LLMs to be misused for harmful purposes, such as spreading misinformation. Engineers strive to improve performance, but model hallucinations – where the model generates incorrect or nonsensical information – remain an issue (Achintalwar et al., 2024). Despite advances in fine-tuning, context understanding, and training techniques, hallucinations persist because LLMs generate text based on patterns in data without true comprehension or real-time external knowledge verification. Reducing hallucinations remains a key area of focus for engineers.

The use of LLMs also raises ethical considerations (Jiao et al., 2024). For example, there are concerns about the privacy implications of LLMs, as they may collect and process large amounts of personal data. Additionally, there are questions about the accountability and transparency of LLM systems. In response, many companies are developing guidelines and regulations to ensure that LLMs are used responsibility and in a way that is beneficial for stakeholders.

While LLMs have made significant progress, they still have several limitations (Brown, 2024). One of those limitation is their reliance on large amounts of data. LLMs require massive datasets to train effectively, which can be challenging to obtain for certain domains. Additionally, LLMs may struggle with tasks that require common sense or world knowledge that is not explicitly present in their training data.

Despite these limitations, LLMs have the potential to revolutionize many aspects of society. Future research and development will likely focus on addressing the challenges and limitations of LLMs, as well as exploring new applications and use cases (Chiarello et al., 2024; Jiao et al., 2024). For example, researchers are working on developing LLMs that are more transparent, accountable, and unbiased. Additionally, there is ongoing research on developing LLMs that can perform more complex tasks, such as reasoning, planning, and problem-solving.

In construction, studies have reported AI being employed in a variety of applications including cost prediction, energy use prediction, construction site safety, structural health monitoring, and resource allocation (Saka et al., 2024). However, implementation challenges have been identified. These include lack of skilled workers, cultural issues, cost of implementation, availability of data, and trust (Akinosho et al., 2020). All have the potential to negatively impact implementation.

LLM in Education

The context of education is not different from any other potential use of LLMs. Budhiraja et al. (2024) examined the perspectives of both students and teachers regarding the impact of LLMs on engineering education. Joshi et al. (2023) examined the utilization of ChatGPT among computer science undergraduate students and explores its influence on their learning. Collectively, these papers demonstrated a wide range of perspectives and opinions on the topic, varying from cautious acceptance to strong enthusiasm among the interviewees. Overall, both educators and learners acknowledge that AI tools have the capacity to augment the learning experience. Simultaneously, there is an acknowledgment of the need for clear ethical principles. The insight indicates a transition towards embracing these emerging technologies and employing them to enhance teaching and learning methodologies.

The research conducted by Lyu et al. (2024) demonstrates a direct and favorable relationship between the utilization of Generative AI tools and enhanced academic achievements among students. However, their study also found that a significant 63% of prompts created by students were considered inadequate, suggesting a deficiency in the necessary abilities to effectively utilize Generative AI techniques. This discovery also indicates the necessity of fostering Generative AI literacy among students. Generative AI literacy refers to the proficiency in efficiently engaging with AI tools and comprehending the process of formulating questions and interpreting responses.

Another potential is in personalized learning experiences (Castro et al., 2024). Tailored learning materials, assessments, and feedback mechanisms are possible all of which could cater to a student's

individual needs and learning preferences. Such personalization coupled with a deeper understanding of the subject matter could foster deeper understanding and engagement (Ivanov et al., 2024).

From the perspective of the instructor, AI may streamline and optimize the development of teaching material (Ivanov et al., 2024). Substantial time is invested in the development of syllabi, quizzes, assignments, and study guides. Generative AI can develop initial drafts of these materials limiting the time educators must invest in this activity and allowing educator's time to be redirected to student interaction and engagement. This implied efficiency in content creation has the potential to elevate the overall quality of instruction (Ivanov et al., 2024).

Perhaps, one of the more dominant discords on LLMs is the question of originality and academic integrity (Kasneci et al., 2023). The technology is extremely promising, but it is necessary to align the potential of the technology with established pedagogy (Kohnke et al., 2023).

LLMs Usage by Students

Arora et al. (2024) studied the usage of LLMs by students, revealing themes such as Language Models (LLMs) as learning resources, their efficacy, usage difficulties, impact on productivity and learning, Prompt Engineering, and the future of LLMs in education. The study suggests that while LLMs can be valuable tools for students, they also raise important questions about their effectiveness, accessibility, and ethical implications.

Students primarily use LLMs as a supplementary learning resources (Meyer et al., 2024). These tools help summarize complex texts, explain difficult concepts, and provide diverse perspectives. Additionally, LLMs assist in practicing writing skills and offering feedback on assignments. However, over-reliance on LLMs may limit critical thinking and problem-solving abilities.

Despite the benefits, students encounter challenges when using LLMs effectively. Formulating clear, concise prompts to elicit desired responses is a common issue (Bashardoust et al., 2024), as is evaluating the quality and accuracy of generated content. Providing training and guidance on LLM usage is crucial to overcome these challenges.

The impact of LLMs on student learning presents mixed results. Some studies suggest that LLMs can enhance student engagement and motivation (Lyu et al., 2024). However, there are also concerns about their potential to promote plagiarism and hinder deep learning (Jošt et al., 2024; Kasneci et al., 2023). Careful consideration of pedagogical implications and strategies to mitigate risks is essential.

In conclusion, LLMs have the potential to transform higher education. However, their successful integration requires careful consideration of their benefits, limitations, and ethical implications. By providing students with appropriate training and guidance, educators can help them harness the power of LLMs to enhance their learning experience while maintaining academic integrity.

Method

This study employs a mixed-methods approach to investigate the utilization of large language models (LLMs) among Building Construction students at Auburn University. Undergraduate sophomore, junior, and senior students were included in the survey. These students are highly likely to have a wide range of encounters with LLMs, which makes them an excellent cohort for studying how these technologies are incorporated into their academic and professional endeavors.

Data Collection

The study utilized purposive sampling, also known as judgment sampling, which involves intentionally selecting a participant based on specific attributes they possess. The technique is deterministic and does not require any underlying theories or a specific number of participants (Tongco, 2006). In essence, the researcher determines the necessary information and seeks individuals who possess the requisite knowledge or experience and are ready to provide it (Bernard, 2002; Lewis & Sheppard, 2006).

An anonymous Qualtrics survey was distributed to a selected sample of construction management students in the fall 2024 semester. The survey included Likert-scale questions, multiple-choice questions, and open-ended responses to gather both quantitative and qualitative data. The survey focused on the following:

- Frequency of LLM usage for coursework and research
- Specific activities for which LLMs are utilized
- Student satisfaction with LLM performance
- Interaction protocols with LLMs
- Student opinions and attitudes towards LLMs
- Influence of LLMs on academic performance and professional skill development

Data Analysis

To analyze the survey data, we employed an approach combining descriptive statistics and thematic analysis. Descriptive statistics summarized the quantitative data, such as the frequency of LLM usage, student satisfaction ratings, and demographic information. These numerical results provided a clear overview of the study population and their experiences with LLMs. Thematic analysis was applied to the open-ended responses, allowing us to identify recurring themes, patterns, and insights related to students' perceptions, attitudes, and behaviors regarding LLMs. In the analysis of perceived impact on grades, a mean analysis of Likert data was used to determine the number of students falling within certain categories of the Likert scale. This method was deemed appropriate for the study's purposes. By combining these two analytical approaches, we aimed to gain a better understanding of how college construction management students utilize and perceive LLMs in their academic and professional endeavors.

Limitations

The study's generalizability is limited due to its focus on a single university. The findings may not be representative of students at other institutions with differing demographics, academic cultures, or institutional policies.

Results

The survey was distributed through the construction management faculty to 748 distinct students and remained open for four weeks. To encourage greater participation, a reminder was sent at the two-week mark. In total, 232 responses were received, of which six were incomplete, yielding an effective response rate of 30%.

The demographic breakdown of respondents showed a predominance of male participants (87%), with an average age of 20. The majority were of junior level standing (43%), followed by sophomore (27%) and senior (30%) levels.

How prevalent is the use of LLMs among building construction students at Auburn University, and what factors influence their adoption and usage patterns?

Respondents were surveyed regarding their use of LLMs for schoolwork, personal use, and internships. In total, 93.8% *(n=212*) indicated using LLMs for at least one of the three purposes. A minority have restricted their usage to just one area, primarily schoolwork or personal activities. Approximately half (n=109) employ LLMs for both schoolwork and personal use, while 32% (n=72) leverage them across all three domains. Detailed breakdowns can be found in Table 1.

Table 1. Usage Patterns for LLMs

	Exclusively for			**Combinations of Use**				**Totals**			
Year Level	S	P	I	S&P	S&I	P&I	S&I&P	S	P	I	All
Sophomore	1	7	0	39	1	0	5	46	51	6	53
Junior	10	5	0	45	0	1	34	85	85	35	95
Senior	1	3	0	25	2	0	33	61	61	35	64
Total	12	15	0	109	3	1	72	192	197	76	212

Note: S=Schoolwork Use, P=Personal Use, I=Internship Use.

When asked about the use of LLMs for schoolwork, 85.0% *(n=192*) indicated they have used LLMs for schoolwork at some point. Currently, however, only 63.7% *(n=144*) of the respondents indicated they are currently using LLMs for schoolwork. Notably, sophomores demonstrated the lowest engagement with LLMs, while juniors exhibited the highest usage rates. Further details on this usage pattern can be found in Table 2.

Table 2. Use of LLMs for Schoolwork

	Have Ever Used LLMs		**Currently Use LLMs**	
Year Level	Yes	No	Yes	No
Sophomore	23.9% (47)	46.7% (14)	19.4% (28)	39.0% (32)
Junior	45.2% (88)	30.0% (7)	47.9% (69)	35.4% (29)
Senior	31.0% (61)	23.3% (9)	32.6% (47)	25.6% (21)
Total	100% (196)	100% (30)	100% (144)	100% (82)

Approximately 33% (n=74) of respondents answered how they were first exposed to LLMs. Of these, 66.2% learned from a friend, 17.6% (n=13) through their job or a teacher, and 16.2% (n=12) via social media or family.

Thirty students not using LLMs cited various reasons, with 46.7% mistrusting the information. Sophomores also mentioned concerns about grades and cheating. Other reasons included no perceived need, not considering its use, and preferring to do their own work.

When asked about instruction on prompt engineering for LLMs, 75.3% had not received any. Specifically, 100% of sophomores, 76.5% of juniors, and 69.7% of seniors indicated a lack of instruction. Those who had received instruction learned from professors, university resources, or online sources. No significant correlation was found between instruction on prompt engineering and LLM usage.

What are the primary use cases for LLMs among building construction students, and how do these use cases vary?

Approximately 24% and 13% of students reported using LLMs for English and Science & Math courses, respectively. Over half used them for courses in their major. When asked how they primarily use LLMs for schoolwork, the most common response (64%) was writing essays, papers, reflections, and speeches. Ten students selected “other,” but their explanations were reclassified under "writing essays" due to overlap. Figure 1 provides a detailed breakdown of the results.

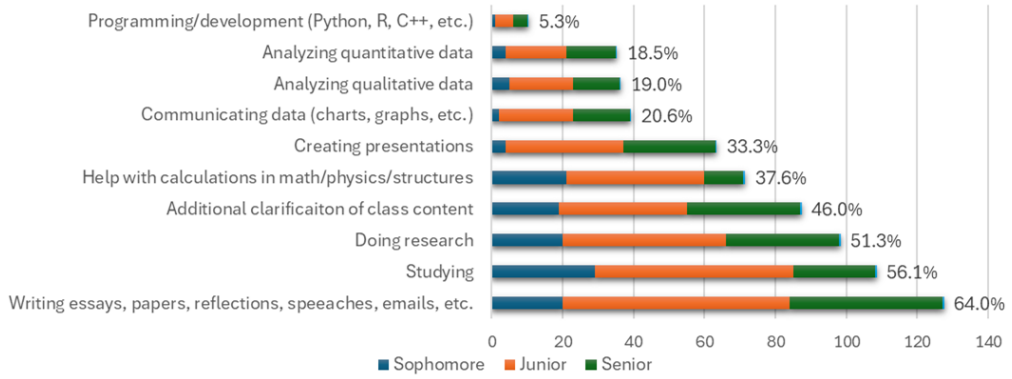

Figure 1. Use cases for LLMs in Schoolwork

How do building construction students perceive the impact of LLMs on their academic performance and learning experiences?

Overall, most students found LLMs more helpful than traditional search engines, with 42.9% finding them somewhat more helpful and 40.2% finding them much more. By year level, 76.3% of sophomores, 85% of juniors, and 84.5% of seniors preferred LLMs.

Students were asked to identify how they believed the use of LLMs impacted their grades on assignments, tests, projects, and overall course grades. They were asked to score the perceived impact on a 100-point interval scale with the following parameter clarifiers: 0-20 = Definitely Hurt My Grade, 21-40 = Probably Hurt My Grade, 41-60 = Did Not Hurt or Help My Grade, 61-80 = Probably Helped My Grade, 81-100 = Definitely Helped My Grade. As mentioned, the question used an interval scale, so students could score these anywhere from 0-100 in increments of 1. All students agreed that LLMs improved assignment grades but had no impact on test grades. Opinions on other grades varied: juniors felt LLMs boosted project and overall course grades, seniors agreed on project grades but were less sure about overall course grades, and sophomores believed LLMs probably helped with project and test grades. Refer to Table 3 for detailed results.

Table 3. Perceived Impact on Grades

Item	Year	Hurt			Helped		
		Definitely ≤ 20	Probably 21-40	Neutral 41-60	Probably 61-80	Definitely ≤ 81	Mean
Assignment Grade	Sophomore	0	0	4	1	9	83.9
	Junior	1	0	3	2	24	90.0
	Senior	0	0	3	5	11	85.5
Test Grade	Sophomore	0	1	11	0	4	60.9
	Junior	3	0	19	2	11	62.9
	Senior	5	0	13	3	5	52.9
Project Grade	Sophomore	2	0	9	0	6	61.8
	Junior	1	0	5	2	19	85.2
	Senior	1	0	3	3	12	82.9
Overall Course Grade	Sophomore	0	1	4	0	7	77.1
	Junior	0	0	6	2	11	81.6
	Senior	0	0	6	6	6	75.0

What are the preferred LLM platforms and tools among building construction students, and how do these preferences relate to their experiences?

ChatGPT Free was the most cited LLM by students (84.6%), while Microsoft Copilot was used by 13.3%. LLM preference did not significantly differ by year level.

Discussion and Conclusions

The integration of Large Language Models (LLMs) in the academic environment has seen a significant increase in recent years, with an astounding 93.8% of students in this study now incorporating these tools into their routines. This prevalent usage spans various domains of their lives, including personal, educational, and professional tasks. The data suggests widespread use of LLMs by students, pointing to a pivotal shift in their approach to learning and problem-solving.

A major insight from the survey reveals that most students (82.4%) were introduced to LLMs through informal networks such as friends and family, while only a small fraction (17.6%) gained exposure through formal channels like jobs or teachers. This implies a gap in institutional efforts to educate students about these tools. The literature review corroborates this by indicating that 63% of prompts crafted by students were inadequate (Lyu et al., 2024), underscoring the need for comprehensive training. Construction Management education has a potential opportunity to significantly impact how students harness the potential of LLMs by providing structured guidance and training.

The mistrust students harbor towards LLMs mirrors sentiments found in the literature (Akinosho et al., 2020), suggesting a widespread skepticism about the reliability of these technologies. This mistrust presents another opportunity for educators in Construction Management to demystify LLMs and illustrate their appropriate applications. Educators can play a crucial role in teaching students to critically evaluate and personalize LLM responses to enhance their learning experiences.

The survey highlights that writing is a dominant use case for LLMs, with 64% of students employing these tools for their classes. Additionally, undergraduate students frequently use LLMs for conducting research and seeking further clarification on class materials. However, this usage pattern indicates a

tendency to treat LLMs merely as advanced search engines rather than exploiting their full potential. This observation reveals that students are only beginning to scratch the surface of what LLMs can offer in an educational setting. There is a significant opportunity for educators to enlighten students on the advanced capabilities of LLMs, thus enriching their educational experience.

While over half of the students use LLMs for studying, they report no improvement in test scores. This suggests either a lack of effective usage or that LLMs are no more effective than traditional methods. Research is needed to understand the link between LLM usage and academic performance.

Lastly, it is noteworthy that a mere 13.3% of students are taking advantage of the university's partnership with Microsoft for LLMs. This low utilization rate indicates a communication gap within the university. It is imperative for the institution to enhance its outreach efforts to make students aware of and encourage them to utilize these valuable resources.
In conclusion, while the adoption of LLMs among students is high, there are several areas for improvement and opportunities for further research. Educational institutions, particularly in the field of Construction Management, have a critical role to play in bridging the knowledge gap, addressing mistrust, and maximizing the benefits of LLMs for academic success. Through targeted training, improved communication, and continued exploration, educators can ensure that students fully leverage the capabilities of LLMs to enhance their learning and professional development.

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