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Enhancing Stakeholder Analysis with AI: A Comparative Study of Productivity and Quality in the Educational Context

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Abstract

This paper examines the application of generative artificial intelligence in stakeholder management while studying the business aspects of software development and project management in two different universities. It explores a novel intersection of AI with software development and project management practices, offering valuable insights for both academia and industry. By investigating how students use AI alongside traditional methods under supervision, this study evaluates the effectiveness, quality of results, and creativity of students' project assignments in identifying stakeholders and defining communication strategies. The findings suggest that AI can enhance work completion speed and contribute to greater project success due to a more complete identification of stakeholders and formulation of innovative stakeholder engagement strategies. There is a consensus, within this context, that while AI can be invaluable for project stakeholder management, human judgment remains essential.

Keywords: Stakeholder Analysis, Information System Development, System Analysis and Design, Project Management, Generative Artificial Intelligence (AI)

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1. Introduction

Recent advancements in artificial intelligence (AI) present new opportunities to support activities in different fields. With its ability to produce content in diverse forms, such as text, images, audio, and software code, AI can potentially transform business and education. Despite varied opinions about these technologies' opportunities, benefits, and drawbacks, disregarding or restricting AI in educational contexts would be unwise.

There has naturally been substantial interest in this area. The topic of generative AI and education has gathered scholarly attention. A recent research paper offers a detailed analysis of generative AI in education by reviewing 207 research papers; the findings include bibliometric analysis and document the notable rise of tools like ChatGPT, underscoring AI's growing influence and potential to revolutionize educational practices [1].

After a year of alarm and caution, we believe that educators have now concluded that integrating AI into curricula is an excellent strategy, especially in some subject areas that align with the capabilities of AI tools. The following domains align well with the capabilities of generative AI: Explaining Concepts, Communication, Creativity, Brainstorming and Decision-Making, Rehearsing and Role-Playing, Summarizing and Reporting [2].

Having taught web design and programming for over two decades, it is interesting to see the evolution of teaching tools from a plain notepad as a code editor and IDEs (Integrated Development Environments) to the use of AI tools for teaching programming. A book by Vissar [3] teaches readers how to develop unique websites using ChatGPT. Even

without prior coding experience, students learn to leverage AI technologies to develop web design skills. The book covers the basics of web design, HTML and CSS and guides readers through setting up their system for web projects. It advances to creating dynamic, multi-page websites with interactive features using JavaScript. Similar books are available to teach Python with AI. A book by Porter and Zingaro [4] teaches readers how to leverage the AI coding assistant Copilot to create functional Python programs, even for those without coding experience. This resource uses AI tools and teaches crafting prompts for Copilot to read and comprehend Python code, test programs, and fix code issues. Students who use AI tools will likely be more productive than students who are told to ignore AI.

2. Background and Motivation

Integrating generative AI into software development education is an important topic of interest for many researchers. For example, the paper by Petrovska et al. [5] explores a structured approach to incorporating AI in a program of study. It presents examples of formative and summative assessments investigating various aspects of ChatGPT, including its coding capabilities, its ability to construct arguments, and the ethical issues associated with using ChatGPT and similar tools in education and the workplace. The innovative use of ChatGPT in education is also being researched [6] in other environments. In her paper, Adair notes that generative AI technologies can transform teaching and learning methods [7]. Several studies have commented on how generative AI can be used in education and software development [5, 8]. We believe that capabilities such as generating text and summarizing information can save time taken to complete student assignments and projects and improve the results of students' written assignments.

AI can enhance students' assignments by introducing innovative, creative elements, broadening their knowledge base, and enriching the outcomes. Instead of sifting through numerous web pages, social media platforms, blogs, or other sources, students can leverage AI tools that synthesize vast amounts of information and provide targeted suggestions directly relevant to their queries.

Students are also anxious about the influence of AI on their learning. A recent paper states, “Students are concerned about actual learning and whether critical thinking skills can be successfully acquired when AI-based tools are used to generate essays. The survey reveals that student reaction ranges between acceptance to rejection” [9].

Another paper [10] investigates the integration of ChatGPT in educational settings, particularly for software programming courses. It highlights ChatGPT's potential to support education by generating human-like responses and facilitating learning through various applications like code suggestion, problem-solving, and interactive learning tools. However, this paper also raises concerns about students becoming overly reliant on AI, which may impede their understanding of fundamental programming concepts and promote passive learning habits. Yet, there was also apprehension about potential drawbacks such as undermining problem-solving skills and the risk of fostering an overdependence on technology solutions. The study underscores the need for a balanced integration of AI tools like ChatGPT in education, ensuring they complement rather than replace traditional learning methods, promoting sustainable educational practices, and deeper learning engagements. As such, there is a need to survey whether faculty and student perceptions of AI have evolved in the past year.

In this paper, we research the “creativity, brainstorming, and decision-making” aspect of computing students' education at the undergraduate level. We seek to examine how AI can be integrated into courses that focus on the critical people aspects of software development, specifically addressing the needs and interests of the stakeholders involved.

Stakeholder analysis is a crucial element in system development and project management, ensuring that the viewpoints of all individuals and groups impacted by a system are recognized, analyzed, and incorporated into the newly developed software product [11].

To be successful in software product development, stakeholder analysis uses techniques that rely heavily on the experience of the practitioner and can be flawed in the absence of such experience [12].

Project leaders must identify all stakeholders successfully, rank and classify them, and identify how they should be engaged.

Undergraduate computer science students, especially those without practical work experience, usually find such tasks more difficult because they lack real-world experience. They might miss some key stakeholders, resulting in a project being challenged or outright failure. Our research aims to investigate how generative AI can help students in this direction.

3. Methodology

In this research, we apply a comparative case study approach within a controlled educational setting to assess the impact of using generative AI for stakeholder management.

Two groups of students enrolled in undergraduate courses and working on software development projects were assigned tasks to perform stakeholder analysis and to find appropriate methods for communication with project stakeholders. Presented are options for using AI or traditional methods for these tasks. This setup enabled direct comparison across key performance dimensions, including task efficiency, quality of outputs, and creativity of stakeholder engagement strategies.

3.1. Participants and context

Participants consisted of two groups of students in two undergraduate courses at Boston University (BU) – USA, and Sofia University “St Kliment Ohridski” (SU) – Faculty of Mathematics and Informatics (FMI) - Bulgaria. These

courses are Project Management (BU) and Information Systems Analysis and Design (SU). They were chosen because they have several common properties.

Both courses discuss the same topic – the role of stakeholder software development and their needs, expectations, and requirements about the newly developed software system. Both courses use team projects as a part of the educational process. Stakeholder analysis is an essential task for student projects.

The first course, "Project Management**",** is a required course in the undergraduate management program at Boston University, USA, with a mix of local working professionals and international students. This introductory course on Project Management provides a comprehensive foundation in the key elements of managing projects effectively within diverse environments and industries. The course covers topics such as the alignment of projects with organizational goals, detailed planning and scheduling techniques, and project management software to enhance practical skills. By the end of the course, students will be equipped with the knowledge and skills to plan, control, and execute projects efficiently.

The target audience that used AI to do project work comprised four teams of 28 students at Boston University. These students were developing websites for the health sector, specifically targeting specialty divisions. Some preliminary conversations occurred collectively.

The second course in our research is "Information Systems Analysis and Design". The curriculum focuses on the object-oriented method for system analysis and design. Most of the course is focused on project-based learning involving requirements analysis and initial system design. A key aspect of these projects is identifying stakeholders and selecting effective communication methods to gather their requirements accurately, which is vital for project success.

Three teams from the Information Systems undergraduate program at the FMI - Sofia University employed AI, and 24 students participated. The teams worked on projects that required the development of small information systems in the entertainment field – films or music distribution.

3.2. Procedure

Considering that the inclusion of tasks requiring AI should be done consistently without breaking the coherence of the tasks for the whole project and contradicting the course's objectives, we carefully chose the tasks where AI could be used.

The tasks selected for using AI involve identifying stakeholders and methods for gathering requirements, analyzing their needs, and designing solutions that align with these requirements. By integrating AI into these tasks, students can leverage AI tools to understand stakeholder roles and interactions, generate user stories, and create requirement documents. This approach enhances the realism of the project scenarios and provides students with practical experience in using advanced technology to facilitate software development processes.

Additionally, AI aids in visualizing software designs and predicting stakeholder reactions to various features, which can significantly improve the iterative design process. By enabling students to perform detailed stakeholder analysis and requirement gathering with the help of AI, both courses aim to cultivate a deeper understanding of the practical challenges in software development, preparing them for real-world scenarios in their future careers.

3.2. Comparative Study of Using AI

We experiment with the usage of generative AI on tasks concerning stakeholder analysis exercises and explore the productivity and quality of the usage.

Students were assigned two basic tasks concerning stakeholder management - identifying project stakeholders and determining methods for communication with them in order to understand their interests.

A specific approach is used to compare results when AI is used and when it is not used. Several key comparative metrics are used:

- Quality of results: Evaluation of the stakeholder register (completeness, justification) and adequacy of the engagement approaches.
- Efficiency of the task completion: The time taken for stakeholder identification with and without using AI is measured for stakeholders. The same procedure is applied for the task concerning methods for requirement gathering.
- Innovativeness of Solutions: Evaluation of the solution proposed with the help of AI and using only traditional methods.

Within each of the teams, students worked in two groups. The first group applied AI to identify stakeholders but did not use AI to determine communication methods. Conversely, the second group used AI to establish communication methods with stakeholders but did not apply AI to identify the stakeholders or their needs.

3.4. The survey

We used a survey to assess how students utilize generative AI in completing their project assignments and how they personally evaluate the results of its application.

As scaled responses simplify analysis, four questions employ 5-point scales. Two more questions were used to measure the time spent on the assignments (see **Appendix A** for detailed questions and scales).

At the end, an individual section is designated for extra remarks from participants. It gave the students the opportunity to share thoughts or feedback that had not been addressed by the structured questions.

4. Results

The survey was conducted among the students from Boston University (BU), participating in the Project Management course, and students from Sofia University (SU), participating in the IS Analysis and Design course.

The primary objective was to evaluate how students utilize AI tools in project tasks and their perceptions of its effectiveness and to compare the results from both universities.

The data collected revealed several key insights regarding AI usage for the specified tasks. In this section, we provide a discussion of the results, compare groups, and identify some trends.

Table 1. The ease of the task

Question 1	Table column heading	
	BU students	SU Students
Difficult		
Challenging		2
Manageable	10	15
Easy	10	7
Very easy	8	

There are no students from Boston University, indicating that tasks were ‘Difficult’ or ‘Challenging’; they found tasks ‘Manageable’, ‘Easy’, or even ‘Very easy’. Most SU students also rated the task as ‘Manageable’ and ‘Easy’, two students noted ‘Challenging’, and no one found the task ‘Very easy, suggesting that the task was a little harder than for BU students.

Table 2. The quality of the work

Question 2	Table column heading	
	BU students	SU Students
High quality	1	
Good quality	7	4
Moderate quality	14	18
Low quality	4	2
Poor quality	2	

Most BU students view the quality as 'Moderate,' with 'Good quality' coming next. Only 3 students rated the quality as either 'High' or 'Poor'. SU students also find the results of using AI are of 'Moderate’ and ' Good’ quality, with no indication of 'High' or 'Poor' quality.

Table 3. The AI’ help in completing tasks faster

Question 3	Table column heading	
	BU students	SU Students
Same time	2	4
Twice as fast	10	11
Three times faster	9	5
Four times faster	6	1
Five times or higher	1	3

BU students indicate a sense of moderate acceleration, falling between 'Twice as Fast' and 'Four Times Faster'. The feedback from SU students is not as positive as BU, mainly stating 'Twice as Fast' or lower.

Table 4. The time spent when AI is used

Question 4	Table column heading	
	BU students	SU Students
Up to ½ hour	10	10
1 hour	18	10
1 and ½ hours		1
2 hours		2
2 and ½ hours		1

All BU students finished their assignments in under 1 hour while using AI. For SU students, the time for completion differs, with the majority also finishing in under 1 hour, while for a few students, it takes 2 hours or more.

Table 5. The time spent when AI is not used

Question 5	Table column heading	
	BU students	SU Students
1 hour		1
1 and ½ hours		9
2 hours	12	7
3 hours	10	2
4 hours	6	6

For BU students not using AI, the task required more time, with a range between 2 and 4 hours. SU students report that the time taken to complete tasks varied between 1 and 4 hours, suggesting that tasks completed without AI help usually required more time.

Table 6. Interest in using AI in the future

Question 3	Table column heading	
	BU students	SU Students
Definitely interested	10	4
Probably interested	16	19
Neutral	2	1
Probably not interested		
Definitely not interested		

Students from both universities show interest ('Definitely' and 'Probably' interested), indicating a significant tendency to use AI again in upcoming projects. It seems that SU students are a little bit less enthusiastic than the BU group.

The results from the answers of the last, open-ended question suggest that while there are some challenges and reservations about the quality and effectiveness of AI, there is also significant interest and perceived benefits in using AI for tasks at both locations, with SU being slightly more critical in ease and quality but equally interested in future use. The results are comparable, regardless, and the differences are attributable to students completing different projects at the two universities.

5. Discussion and Implications

The results of this study outline that AI can improve stakeholder analysis, not only in tasks requiring speed but also with broader data scanning and structural consistency. When utilizing AI, students demonstrated more elements in the stakeholder identification list and methods for requirements gathering. AI significantly reduces the time required to complete tasks, enhancing efficiency.

Students present good results when directly identifying and engaging with stakeholders, bringing a detailed and contextual understanding to the process. This hands-on approach ensures a user-centric solution tailored to meet the nuanced requirements of various stakeholders.

In contrast, AI tools like ChatGPT excel at rapidly aggregating and analyzing large volumes of data to provide comprehensive lists of potential stakeholders and their generalized needs. In addition, the description of methods for requirements gathering showed more structured formatting due to AI-guided templates.

However, this broad overview may lack the depth required to grasp certain sectors' unique cultural and operational nuances fully. Therefore, AI's contributions need further refinement by human agents to ensure relevance and accuracy.

Overall, students from both universities agree that the use of AI saves time. On the other hand, the use of AI raises concerns about the reliability and accuracy of the results. The opinions on the quality of the work vary. To avoid this, students try to adapt their interaction methods, experimenting with strategies to maximize AI utility.

From a pedagogical perspective, incorporating AI tools into stakeholder analysis exercises can improve the learning experience. Students gain practical skills to work with emerging tools they will encounter in industry, while also practicing a critical view of their use.

However, educators must carefully design assignments that balance AI tool use with reflective, human-centered thinking. Providing structured prompts for validating AI outputs, integrating appropriate tasks, and including manual cross-checking activities can help students not to passively rely on technology.

6. Conclusion

This paper describes the practical effects of employing AI in education, including enhanced speed and productivity, while emphasizing the need for human involvement to ensure accuracy. Merging these abilities can boost opportunities for project success. The study also reveals the irreplaceable role of human judgment in interpreting, contextualizing, and ethically applying AI-generated suggestions. AI should not be used as a replacement for analytical thinking, it should be seen as a tool helping to improve students' skills, especially in complex tasks that require extensive research and collaboration. Our research findings align closely with the principles outlined in a recent book, "*AI-Powered Leadership"* [13]. The book introduces the "Both/And" leadership approach, advocating for a harmonious blend of AI capabilities with essential human skills such as critical thinking and ethical decision-making. This perspective supports our conclusion that AI should serve as an augmentative tool, enhancing human expertise rather than replacing it, particularly in complex, collaborative tasks that demand nuanced understanding and ethical considerations.

Compared with similar research from a year ago, we believe more students acknowledge the benefits of AI in saving time and providing an opportunity to enhance the scope of their work. Therefore, if AI is introduced in courses, we should expect more from students. It provides us with an opportunity to enhance the depth of our curriculum. However, we should continue to remain cautious about AI's reliability and introduce processes to validate its outputs carefully. Indeed, while our research validates the advantages of efficiency and broad idea generation within the context of stakeholder analysis assignment, it also emphasizes the need for critical engagement with AI's output to mitigate errors. With the integration of AI in education, we will continue to witness students employ a dual approach—leveraging AI for its strengths while compensating for its weaknesses. With a strong foundational education in software development practices, they will successfully integrate good outputs, eliminate incorrect responses, and provide valuable contributions.

Future research could include other courses and universities to expand the sample size across multiple

institutions and education fields. The scope of tasks that can use AI can also be expanded.

Appendix A. The Survey

Question 1: On a scale of 1-5, how would you rate the ease of creating the assigned task with AI?

- **Difficult:** Requires significant effort and expertise to complete. Challenges are frequent, and solutions are not readily apparent.
- **Challenging:** Moderately hard to accomplish; requires good skill and effort. Occasional assistance might be necessary.
- **Manageable:** Requires some effort but is generally straightforward. The task can be accomplished with a fair amount of ease and occasional challenges.
- **Easy:** Simple to perform with minimal challenges. Skills and resources are adequately sufficient to complete the task smoothly.
- **Very Easy:** Requires very little effort or skill to complete. Solutions are obvious and can be executed quickly and efficiently.

Question 2: On a scale of 1-5, how confident are you about the quality of the work created by AI?

- **High Quality:** The output is excellent, accurate, and highly relevant. It consistently meets or exceeds expectations with precise and valuable information.
- **Good Quality:** The output is reliable and generally accurate, with minor discrepancies or areas for improvement. It meets expectations with only occasional adjustments needed.
- **Moderate Quality:** The output is acceptable but may lack detail or accuracy in some areas. It serves the basic requirements but could benefit from further refinement
- **Low Quality:** The output often contains errors or irrelevant information. It requires significant corrections or oversight to be useful.
- **Poor Quality:** The output fails to meet basic standards of accuracy or relevance. It is consistently flawed and requires extensive modification to be of any use.

Question 3: On a scale of 1-5, if you used AI, did it help in completing the task faster?

- **Same Time:** AI integration did not alter the speed of completion. Tasks take as long as they would without AI assistance.
- **Twice as Fast:** AI has helped in doubling the speed of task completion. Tasks that normally take a certain amount of time can now be completed in half that time.
- **Three Times Faster:** The use of AI has tripled the speed of completion compared to performing tasks manually. Efficiency is significantly improved, with tasks being completed three times as quickly.
- **Four Times Faster:** AI assistance has quadrupled the speed of completion. Tasks are completed with remarkable speed, taking only a quarter of the usual time.
- **Five Times or Higher:** AI dramatically accelerates task completion, making processes five times faster or more. The speed increase greatly surpasses standard expectations.

Question 4: For those who used AI, approximately how long did it take you to complete your activity? (e.g., 1 hour, etc.)

Question 5: For those who didn't use AI, how long did it take you to complete your task? (e.g., 1 hour, etc.)

Question 6: Would you be interested in using AI for future projects?

- **Definitely interested:** I see significant potential in using AI and actively seek opportunities to incorporate it into my projects.
- **Probably interested:** I am open to using AI and would consider it based on its relevance and benefits to the project.
- **Neutral:** I am indifferent and need more information to make a decision.
- **Probably not interested:** I have reservations about using AI and would be hesitant unless it shows clear advantages.
- **Definitely not interested:** I do not see a benefit in using AI for my projects and prefer not to use it.

Question 7: Provide additional comments or feedback on the experiment or the method you used

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