Generative AI in Final Year Projects

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ABSTRACT

CONTEXT

While many are focused on the impact of Generative AI on report writing and ideation, these effects are well studied and documented. Wider implications in the engineering field, however, have only begun to be explored, and we seek to further the understanding of the impact of these tools within the field.

Using Final Year Projects (FYP) as a wide net of different project types, this paper seeks to explore how engineering students use Generative AI in their FYP outside report writing and grammatical enhancement.

PURPOSE

This study investigates the different ways in which engineering students use Generative AI for their FYP to begin to explore the true ability of this technology.

APPROACH

Every student was required to complete a questionnaire pertaining to their project. Students in their first semester were asked how they thought they were going to use Generative AI, and students who were about to complete their FYP were asked how they used Generative AI in their projects. Regardless of where the students were in their project, they were required to discuss their use of Generative AI with their project supervisor as well as reference this correctly.

ANTICIPATED OUTCOMES

The anticipated outcomes of this research are context to inform assessment policy, teaching resources, student guidance and how we allow the use of these tools in FYP or similar projects in the future.

Rather than preclude students from using all or certain forms of Generative AI, our study will help to inform a response to the emergence of these tools and provide valuable insights which can be shared within the community of FYP academic supervisors and the greater engineering academic community.

SUMMARY

The widespread access to Generative AI has raised questions around academic integrity and how students will acquire and demonstrate research capabilities, but at this stage it is not understood how these tools can be used beyond report writing and how well the information generated by them will be able to be validated.

We anticipate the outcomes of this paper will provide insight and recommendations to academics who are supervising FYPs or similar projects and inform the policies that govern such assessments.

Introduction

Final Year Research Projects (FYPs) are critical components in the educational trajectory of undergraduate engineering students, serving as integrative experiences that consolidate and apply the theoretical knowledge and practical skills acquired throughout their studies. These projects, often synonymous with capstone experiences, bridge the gap between academic learning and professional engineering practice, as well as fostering a seamless transition to budding professionals.

The essence of FYPs lies in their exploratory nature, requiring students to take an open-ended approach to problem solving by delving into existing literature, identifying knowledge gaps, formulating research questions, and employing suitable methodologies to derive solutions to these engineering problems.

Students are encouraged to tackle contemporary issues, harnessing cutting-edge technology and innovative approaches to contribute to the field. Furthermore, these projects imbue students with a set of invaluable skills, including critical thinking, research methodology, problem-solving, project management, and communication. These projects also instill a deeper understanding of the ethical, social, and environmental impacts of engineering, preparing them for the multifaceted challenges of their future careers while fulfilling the requirements defined by the Washington Accord (Thambyah, 2011).

The Washington Accord was signed in 1989 and is the international agreement that recognises the equivalency of various engineering qualifications around the world (Thambyah, 2011), and FYP becomes a crucial component of the degree program as it where students display the aforementioned techniques.

Navigating the decision of whether to permit students to utilize Generative Artificial Intelligence (AI) tools like ChatGPT for their Final Year Research Projects (FYPs) presents a unique set of challenges for academics. On one hand, Generative AI technologies can significantly enhance the research process by providing instant access to a wealth of information, assisting in data analysis, and even aiding in the drafting of reports, but it can lead to academic integrity issues (Menekse, 2023). These tools can act as valuable supplements to traditional research methods, facilitating students in exploring and understanding complex engineering concepts more effectively and efficiently. However, the use of AI also raises concerns regarding academic integrity, the authenticity of students' work, and the development of critical thinking skills.

Some academics are concerned that students relying too heavily on AI might compromise the student's ability to think, analyse, and solve problems independently (Menekse, 2023), all of which are crucial competencies that FYPs aim to develop. Moreover, without careful monitoring, there's a risk of students submitting AI-generated work as their own, inadvertently promoting plagiarism and undermining the educational objectives of these capstone projects. Therefore, academics need to tread carefully, possibly considering a structured, supervised integration of Generative AI tools in FYPs, where the focus is on aiding rather than replacing the student effort and creativity.

In this initial phase of our exploratory research project, rather than imposing restrictions on the use of Generative AI tools like ChatGPT, we have decided **to adopt an observational approach to understand how students integrate these tools into their FYPs**. Recognising the transformative potential of AI in research processes, we are committed to providing students with the freedom to explore and leverage a variety of technological resources and tools that mirror the dynamic landscape of contemporary engineering practices.

Context

Generative AI applications are built on foundational models and can be adapted to various tasks such as large language models (Johri et al, 2023) and diffusion models for image and video generators (Menekse).

Generative AI has been around in some form or other with 'the first known program called ELIZA being developed in 1966, using simple pattern-matching techniques together with a template-based response mechanism' (Nikolic et al, 2023). However, in early 2023, a Generative AI program called ChatGPT caused concern from the leaders at Universities on how they might bring their staff up to speed with the potential impact of a tool that can replicate a written report in less than an hour.

In response to this concern, Monash University made it mandatory for all units in the university to include a statement on the allowed use of Generative AI for the unit.

There were three statement types a Chief Examiner could apply to a unit. Chief Examiners could decide to allow the use of Generative AI in all assessments, permit selective uses for Generative AI in the or disallow the use of Generative AI in the unit completely.

If a unit allowed the use of Generative AI tools to be used then a qualifying statement needed to be supplied to the students to restrict the use of Generative AI, restrict the type of Generative AI that could be used, to restrict the way Generative AI is to be used or to have no restrictions on the use of Generative AI at all.

The assessment regime for FYP is broken down into two semesters of work and the deliverables required of students are:

- First semester of FYP
    - Project Proposal - due in Week 6
    - Progress Report - due in Week 12
- Second semester of FYP
    - Project Poster - due in Week 11
    - Project Video - due in Week 11
    - Final Report - due in Week 12

Due to the nature of the kinds of projects that are seen within the faculty of engineering, it was determined that there would be no restriction on the kinds of Generative AI that was allowed to be used in FYPs. Students were only required to complete the questionnaire for the Progress Report and the Final Report.

The progress report is a technical report that is submitted at the end of the first semester of FYP. It is expected that the student or team has given significant thought to the problem they are going to solve or research, completed a fairly substantive literature review or state of the field, and decided on the best course of action given the review they have completed - including methods, timeline, and approach. That the student or team have looked at the occupational health and safety of the project, the risks to success they might face and the implications the project has on sustainability. Research relevant and reliable literature to evaluate the state of the field.

The final report is a technical report that builds on the student or group's progress report. It highlights the key findings of the project, discusses the findings and presents an opportunity to reflect on the project successes.

The FYP coordination team had to determine which statement would be most appropriate to apply to the assessments and how best to navigate the concerns without removing something valuable from the students' learning. Due to the predominance of written assessments in FYP, the knee jerk reaction might have been to use "Generative AI tools cannot be used for any assessments in this unit." although this may also preclude any positive use of Generative AI. There was no evidence to suggest how students might be using Generative AI in this context, even for report writing, so

eliminating the use of this tool altogether might be limiting the advancement in education in the future.

It was decided to allow students undertaking FYP to use any Generative AI they liked, but to continue to monitor and observe how this technology was being utilised. To enable this, as part of their assessment, the students had to answer a questionnaire to disclose the usage of Generative AI in their project. A simple questionnaire was developed to determine how students were utilising Generative AI in their projects.

The benefits of students using Generative AI to support solving wicked problems is in the early stages of investigation as the tools with which to do this are only now becoming widely available.

Methodology and Methods

Methodology:

In the preliminary phase of our research on the implementation of Generative AI in final year projects (FYPs), we employed a quantitative research approach. This approach was selected for its suitability in providing clear, objective, and measurable data that allows for a structured understanding of a phenomenon. In the context of our study, this methodological choice was essential to ascertain the specific ways students plan to incorporate Generative AI into their projects, and to measure the extent of its integration. Given the rapidly growing interest in Generative AI and its application in diverse fields, it is imperative to adopt a methodology that can capture the specifics and nuances of its usage among students. The quantitative approach lends itself effectively to this objective, enabling a concise assessment of patterns, trends, and dominant features of Generative AI application in FYPs (Creswell, 2002).

Methods:

Data Collection:

At Monash University, FYP is run as a faculty wide pair of units. As such we have 700+ students enrolled in the unit across two campuses that we can access for information. Students are able to work in teams or as individuals on projects that are from any discipline as long as they meet the necessary skill set for the project. This has allowed a significant spread of project types and increased the base disciplines that a student can investigate.

A structured questionnaire was designed and distributed among students involved in FYPs. The questionnaire was developed and given as part of the student's assessment requirements. The questionnaire comprised closed-ended questions that revolved around:

1. The nature and scope of their project.
2. The intended role of Generative AI in their research process (students completing the first semester of FYP)
3. The actual use of the Generative AI and the ways of validating its responses (students completing the second semester of FYP).
4. The degree of engagement in a discussion about the use of Generative AI with the project supervisor

The supplied list of potential uses of Generative AI the students were able to choose from was:

- As a fundamental aspect of the study (i.e., this is a study centred on generative AI, human interaction, associated ethics, etc.);
- For the operation of robotics (writing code and control systems);
- Thematic analysis (uploading transcribed interview data for coding purposes);

- Audio Transcription (uploading audio files to convert to text);
- Text Analytics;
- Initial research (searching for relevant papers or fields of research);
- Text summarisation;
- Idea generation (where to start with a partially defined problem or to find possible solution pathways);
- Mathematics (generating or solving complex mathematical models);
- Coding/scripting;
- Writing assistance;
- Paraphrasing;
- Data Visualisation;
- Machine Language Translation;
- Proofreading;
- Generation of novel content (graphics, images, writing, videos and datasets) and
- Other.

Data Analysis:

The data was collected using Google Forms, and it was processed using Google Sheets. Descriptive statistics were first generated to provide a general overview of the responses (Borrego et al., 2009). This quantitative approach was considered appropriate as it not only provides a clear snapshot of the current status of Generative AI's integration in student projects but also establishes a foundation for more in-depth qualitative research in subsequent phases. The ultimate objective is to harness the insights gained to draft robust guidelines and policies that ensure the effective and ethical integration of Generative AI tools in addressing complex, wicked problems in FYPs and beyond.

Results and Discussion

This study had 679 responses across the two data sets. 380 responses were from students in their first semester of FYP and 299 responses from students in their second semester of FYP. Students were from both the Clayton campus in Australia and the Subang Jaya campus in Malaysia.

As part of their assessments, 72% students from Australia and 28% students from Malaysia submitted the questionnaire. Of the students who were at the end of their first semester of FYP, only 51.1% used Generative AI in their project, and only 49.1% of students in their second semester of their FYP used Generative AI.

The breakdown of the usage of Generative AI can be seen in the table below.

Table 1: Questionnaire Results

Total Responses	679				
Responses	**Raw Number**	**Percentage of Total**	**Responses**	**Raw Number**	**Percentage of Total**
Sem 1 Unit total responses	380	56.0%	**Sem 2 Unit total responses**	289	42.6%
Australia	274	72.1%	Australia	117	40.5%
Malaysia	89	23.4%	Malaysia	172	59.5%

No Gen AI usage					
Sem 1 Unit total responses	186	48.9%	**Sem 2 Unit total responses**	147	50.9%
Australia	152	55.5%	Australia	72	61.5%
Malaysia	34	38.2%	Malaysia	75	43.6%
Generative AI Used for Writing Assistance					
Sem 1 Unit total responses	100	14.7%	**Sem 2 Unit total responses**	112	38.8%
Australia	60	8.8%	Australia	29	24.8%
Malaysia	40	5.9%	Malaysia	81	47.1%
Used for Ideation or initial research			**Validated Responses**		
Sem 1 Unit total responses	60	15.8%	**Sem 2 Unit total responses**	111	38.4%
Australia	40	14.6%	Australia	34	29.1%
Malaysia	20	22.5%	Malaysia	75	43.6%
Used for Fundamental Aspect of the Project					
Sem 1 Unit total responses	32	8.4%	**Sem 2 Unit total responses**	11	1.6%
Australia	23	8.4%	Australia	5	4.2%
Malaysia	9	10.1%	Malaysia	6	3.5%

Table 1 presents compelling insights into the adoption and utilisation of Generative AI by engineering students across two semesters and geographical locations.

From the total of 679 responses received, a distinct divide is evident between Sem 1 and Sem 2 students. While the former contributed to 56% of the responses, the latter made up 42.6%. Delving deeper, geographical disparities come to the fore. In Sem 1, a substantial 72.1% of responses originated from Australia, with Malaysia trailing at 23.4%. Contrarily, Sem 2 showcased a shift in this trend, with Malaysian responses (59.5%) overtaking their Australian counterparts (40.5%).

Despite early apprehensions from universities about students employing Generative AI for projects (Thambyah, 2011), it's notable that students haven't extensively adopted these tools. The worries raised by university leaders in 2023 (Nikolic et al, 2023), while justified, haven't materialised as anticipated. This provides educators with an extended window to strategise and determine the most effective approaches to integrate these tools.

These results show us that, at this time, if students are using Generative AI in relation to their FYP, the majority are using it for writing purposes and ideation, but there is very little use of Generative AI in these kinds of projects beyond that. We are hoping that as this study develops we can track how this changes (if at all).

Now, turning our attention to the core query - the application of Gen AI. Approximately half of the respondents across both semesters refrained from utilising Gen AI in their projects. This poses an intriguing question about the possible barriers or lack of awareness that might be inhibiting wider adoption.

However, the instances where Gen AI was deployed offer interesting insights:

- Gen AI's role in writing assistance was markedly higher in Sem 2 (38.8%) than in Sem 1 (14.7%).
- Around 15.8% of Sem 1 respondents leveraged Gen AI for ideation, a phase critical for research innovation.
- Only a fraction perceived Gen AI as fundamental to their projects, with Sem 1 at 8.4% and Sem 2 at a scanty 1.6%.

The geographical dissection of Gen AI adoption reveals intriguing patterns. Malaysian students in Sem 2 exhibited a higher inclination towards Gen AI for writing assistance (47.1%) compared to their Australian peers (24.8%). This could be attributed to varying educational paradigms, accessibility, or curriculum emphasis between the two regions.

In the initial semester of their FYP, 14.7% of students employed Generative AI for report writing. However, by the second semester, this figure surged to 38.8%. One possible explanation for this spike might be the increased significance of the final report's grade compared to the progress report. Additionally, as students approach the end of their course, the urgency to secure better grades, and consequently, enhanced post-graduation opportunities, could drive them to utilise such tools.

In our research, we also looked into the specific ways students employed Generative AI. At a closer look, when students highlighted that they utilised Generative AI as a core component of their project, we observed that, despite the modest figures, most of them leveraged the technology primarily for coding tasks, such as generating or debugging code.

This study is in its infancy, these results can inform research by showing how students are starting to use Generative AI tools to assist students in solving wicked problems. As the usage of these kinds of tools are increased, and the information generated increases in quality, academics alike will need to be transparent about how Gen AI tools are being used, and share the potential drawbacks and benefits with their students (Menekse, 2023).

The future of this study hopes to continue to monitor the use of Generative AI to see if the use will increase, to ensure students are being open about the use with their project supervisors, to see why students would use Generative AI over other resources when they encounter obstacles to their learning and how we, as academics, can support students use these tools to enhance their capabilities and learning, rather than just as an integrity issue.

It is hoped that the continuation of this study can support academics with implementing strategies to support challenges or barriers to implementing Generative AI into FYPs.

Limitations

This study has some limiting factors. It was noted that some students did not complete the required Generative AI questionnaire. Speculatively, this could be for a number of reasons, including the perceived negative connotations of the use of Generative AI, or the power imbalance between student and unit coordinators.

At the time the data was gathered, the supervisors of the projects were not consulted to ascertain if the information provided by the students had been discussed, nor if it was accurate. Furthermore,

there was no reliable way of detecting the use of Generative AI. As this study continues these limitations may need to be addressed, especially if a reliable way of detecting the use of Generative AI becomes available.

This study is exploratory in nature as this phenomenon is only now becoming powerful enough to give more realistic answers and be accessible to the wider population. This study will be ongoing.

Conclusions

So far, the results suggest that students predominantly use Generative AI for assistance in report writing. This emphasises the need for clear guidelines on academic integrity, and it's essential we highlight any potential pitfalls of such usage to students.

There's a segment of students leveraging Generative AI for brainstorming and preliminary research. This calls for a closer look at how we teach idea generation early in their academic journey.

Additionally, 14 projects involved the creation or utilisation of Generative AI, and some students incorporated it for coding or scripting. No other significant insights were gleaned from the students' Final Year Projects (FYP). It's noteworthy that since Generative AI only became widely accessible recently, the current cohort might not be as informed about its potential benefits as incoming students.

With more in-depth research, we aim to determine effective teaching strategies and pinpoint areas that might need enhancement.

Acknowledgements

References

Borrego, M., Douglas, E.P. and Amelink, C.T. (2009), Quantitative, Qualitative, and Mixed Research Methods in Engineering Education. Journal of Engineering Education, 98: 53-66. https://doi.org/10.1002/j.2168-9830.2009.tb01005.x

Creswell, J.W. 2002. Research design: Qualitative, quantitative,and mixed methods approaches. New York: Sage Publications.

Aditya Johri, Andrew S. Katz, Junaid Qadirl, Ashish Hingle (2023) Generative artificial intelligence and engineering education

Ashvin Thambyah (2011) On the design of learning outcomes for the undergraduate engineer's final year project.

Muhsin Menekse (2023) Envisioning the future of learning and teaching engineering in the artificial intelligence era: Opportunities and challenges.

Sasha Nikolic, Scott Daniel, Rezwanul Haque, Marina Belkina, Ghulam M. Hassan, Sarah Grundy, Sarah Lyden, Peter Neal & Caz Sandison (2023). ChatGPT versus engineering education assessment: a multidisciplinary and multi-institutional benchmarking and analysis of this generative artificial intelligence tool to investigate assessment integrity, European Journal of Engineering Education, 48:4, 559-614, DOI: 10.1080/03043797.2023.2213169

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