KEEPING AI GENERATED COURSE TEXT ON TOPIC: A TWO STAGE APPROACH TO CONFIRM SUBJECT FOCUS

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Abstract

As they begin creating a new course, many institutions start by creating a set of intended learning outcomes. After this, the materials and assessments are written to align with this list. In this project, we have begun to use these learning outcomes in two ways which together seem to provide a robust approach to confirming whether generated text is sufficiently on topic. Once learning outcomes are defined, prompts can be developed for generative AI to produce course text that delivers these. In addition to manually checking that the resulting text is a suitable response to the prompts, we find we can also use a new prompt to ask the large language model (LLM) what learning outcomes it would associate with the text. By comparing this generated list of learning outcomes with the original, we are triangulating the generated text. The intention is that whilst we would not expect the exact wording of the learning outcomes to match, any difference in the content of the two lists would indicate a subject area that may be over or underrepresented. The second approach is a method to mitigate the randomness that AI generated text can exhibit in relation to prompts. We know that if we use the same prompt, we expect to get a different response each time it is used. Therefore, if we use a LLM to generate a table mapping which learning outcomes are covered by a text, we would not expect to produce the same table every time. Some of these tables will have incorrect entries. This method uses repetition to create multiple tables that are then aggregated to reduce the impact of random errors in the mapping. We describe each of these approaches, giving examples and consider whether a combination of these approaches provide relatively robust in helping to ensure text is focussed and covers what is needed.

Keywords: GenAI, curriculum authoring, quality.

1 INTRODUCTION

Universities, like many other organisations, and the public more widely are grappling with how to accommodate and work with Generative Artificial Intelligence (Gen AI). This category of technology has been in the public domain since November 2022 and as the initial hype subsides, we find we are in fact transitioning to a new paradigm. One in which AI and Gen AI will become ubiquitous. In this paper we consider some aspects of how we might use Gen AI within universities to assist with curriculum development. In our own university, we are running several projects and are finding there are many ways in which Gen AI might benefit the process without undermining academic integrity [1, 2]. In fact, it appears that Gen AI could have a positive impact, in productivity terms, on almost all steps within the process. The diagram in Fig. 1 illustrates this with a sample range of examples.

For those responsible for shaping the curriculum working with learning outcomes, a requirement in many institutions, is a particular challenge. A small number of learning outcomes are expected to represent the intended learning associated with a module or course, in language that makes sense to potential students, as well as cover benchmark statements and any external requirements. Assessment should provide opportunities for students to demonstrate these learning outcomes. Constructive alignment is often used as an approach to ensure expectations, materials, and assessment are aligned [3]. Tables are also often used to map coverage and development of learning outcomes throughout a course. This paper focuses on two approaches that can use Gen AI to assist with managing learning outcomes. The first is a triangulation method that can be used in checking whether generated text in on topic with respect to the learning outcomes and the second is an aggregation method that recognises the stochastic nature of LLMs and to build a picture of the level of confidence in mapping text and learning outcomes.

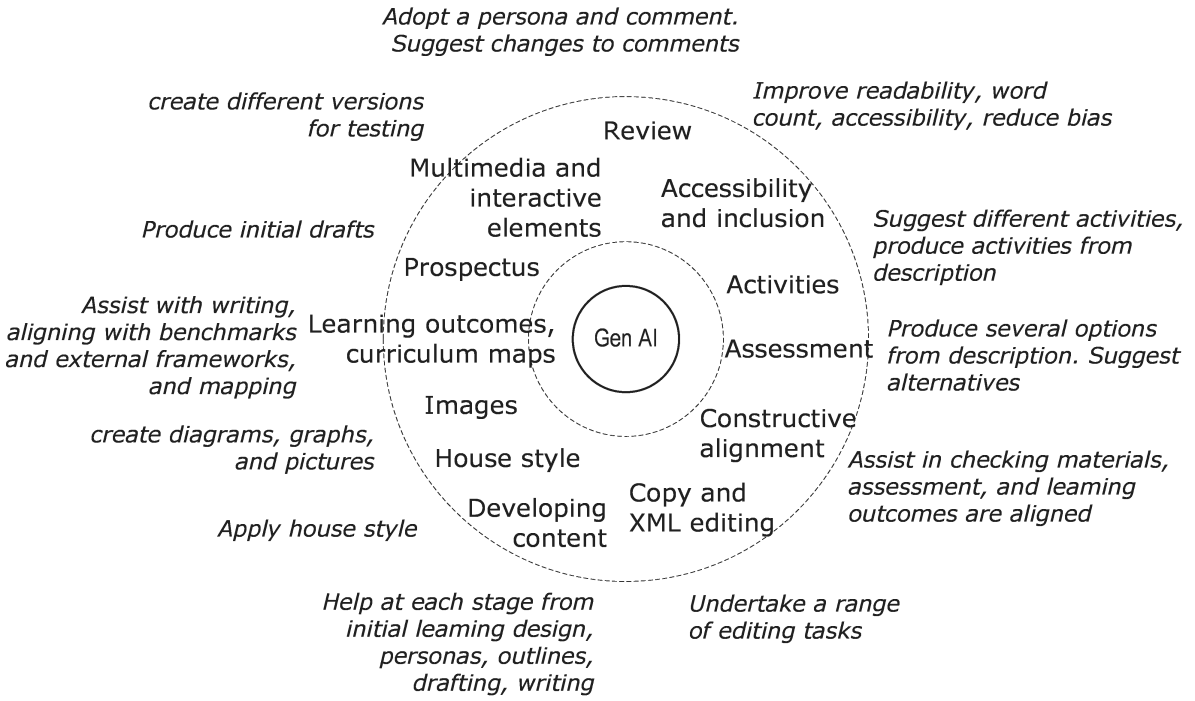

Figure 1. Some examples of how Gen AI can assist a range of activities within curriculum development. The inner ring are the activities in alphabetical order. The outer ring indicates some of the ways in which Gen AI might be used.

2 METHODOLOGY

For each of the two use cases we piloted a proof of concept trial to test the implementation and the potential benefit describing each in turn.

2.1 Triangulation of learning outcomes

This is proposed as a method to assist in ensuring course text stays focused on the relevant learning outcomes. It involves starting out with a set of defined intended learning outcomes for a course, or smaller segment of learning. For this method to work, it does not matter how this list was arrived at. For example, it could be created by a subject expert who knows exactly what they want to cover, defined by an external organisation, or produced using Gen AI. The steps we describe are set out in Fig. 2 below.

The next step is to prompt the LLM to generate course content that delivers these intended learning outcomes. The LLM could be solely relied on to do this. However, this is likely to be considered to introduce copyright issues. Another method could be used to ensure the LLM calls on the institution's own material rather than any of its training data. The most accessible of the approaches to achieve this is Retrieval Augmented Generation (RAG). The prompt used may need to be gradually refined in order to improve the relevance and quality of the generated text.

Once you have a text that is judged to be usable, the third step is to ask the LLM, in a new conversation to generate the learning outcomes that it would associate with this text. Again, some iteration might be necessary to obtain learning outcomes at the correct level and format.

The final step is to compare these generated learning outcomes with the initial set. These two sets are extremely unlikely to be identical. However, we can make a judgement as to whether they are roughly equivalent, or whether items have been added or omitted. If either of these are evident, the text may be adjusted accordingly, either through repeating with refined prompting, or through the subject knowledge of the academic with responsibility for the curriculum.

It is important that the original sources and authors are cited and RAG implementations should be able to do this.

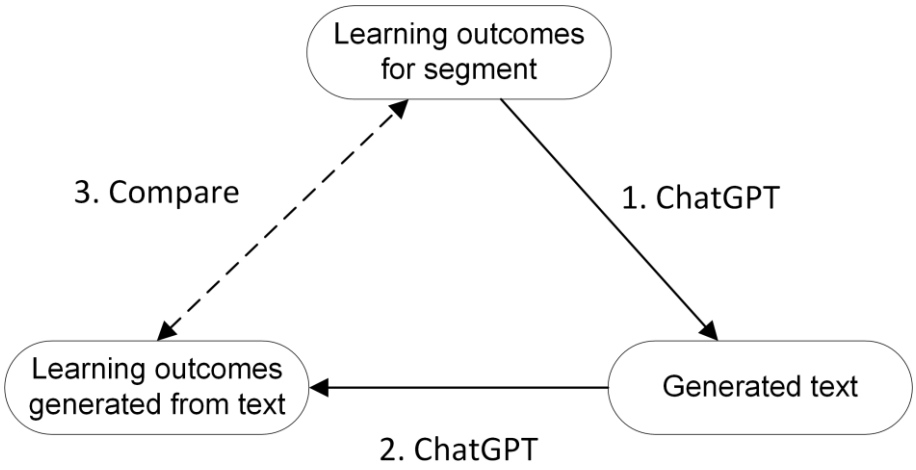

Figure 2. The triangulation of learning outcomes.
Steps 1 and 2 are two separate conversations with ChatGPT. Step 3 is a manual activity.

2.2 Improving confidence through aggregation

This approach recognises that if we use exactly the same prompt several repeatedly, each time in a fresh conversation with ChatGPT, we will obtain a range of generally similar but not identical results. If we have a series of texts and want to map a set of learning outcomes against these, we could ask ChatGPT several times to produce a table showing the mapping and get a slightly different result each time. We can make use of this variation to give some indication of confidence in a mapping by repeating it say ten times and aggregating the scores. We create a table with each extended text item represented by a row and each learning outcome by a column. Where there is an association between a learning outcome and a row, we enter a '1' into the relevant cell and where there is not, a '0'. Where a match is found in every one of our ten attempts the aggregated score in that cell would be '10'. Where no match was found in any of the attempts, there would be a '0'. There could also be any score in between.

The proposal is that where there is a score of '10' we can be very confident there is a link between the text and the learning outcome. Similarly, if there is a '9' as this was different only one in 10 times. Also, where there is a '0', or '1', we can be fairly confident there is no link. All other values would have a greater uncertainty.

This method was trialed on the full descriptions for one hundred and thirty-five online learning materials against twenty-one learning outcomes in an attempt to identify the materials most likely to cover the learning outcomes.

3 RESULTS

In this section we consider the results from each of the two use cases in turn.

3.1 Results from the triangulation of learning outcomes

This method was applied to the first section of text in a project attempting to develop a short course called A beginners' guide to project management using ChatGPT. One member of the project team prompted ChatGTP to develop text that covered the topic, 'An introduction to project management' covering the following learning outcomes:

- Define project management and articulate its significance in organisational success
- Recognise the basic elements of a project: objectives, requirements, and benefits
- Identify and describe the key processes integral to project management
- Apply basic project management concepts in given scenarios or discussions.

The resulting section of the course contained 2,681 words. Separately, in other instance of ChatGPT this text was included within a prompt along with a request to identify the learning outcomes covered by the text. This was repeated 3 times, each in a new conversation. The learning outcomes identified by the LLM are:

Take 1:

1. Describe the fundamentals and importance of project management in various organisations.
2. Identify the roles and responsibilities of a project manager.
3. Understand how project management contributes to organisational success by aligning tasks with goals, adapting to changes, and fostering teamwork for skill development.
4. Reflect on their personal experiences related to task organisation and planning.
5. Clearly define the concept of project goals and requirements and understand the significance of the SMART goals framework.
6. Recognise the different tangible and intangible benefits of a project and their alignment with project goals and the broader organisational strategy.
7. Understand and explain the five key project management processes - Initiating, Planning, Executing, Monitoring and Controlling, and Closing.
8. Apply the concepts of project management processes to real-world scenarios or case studies.
9. Analyse a chosen real-world project, identify key project management processes in it, and summarise their findings.

Take 2:

1. Understand the fundamentals of project management and its increasing relevance in diverse organisational contexts.
2. Comprehend the roles and responsibilities of a project manager in execution and coordination of a project.
3. Identify the significance of project management in fulfilling the organisation's goals, enhancing efficiency of time and resources, managing risks, ensuring quality, and fostering clear communication.
4. Distinguish between the concepts of project goals and requirements, and their relevance in project planning and execution.
5. Apply the SMART goals concept to create precise and effective project objectives.
6. Recognize potential benefits of a project, both tangible and intangible, and their strategic alignment with an organisation’s broader goals.
7. Understand the process of project management broken into five fundamental categories: Initiating, Planning, Executing, Monitoring and Controlling, and Closing.
8. Apply the knowledge of project management processes to real-life projects and observe their practical implementation and influence on the success of the project.
9. Review and assess your understanding of the fundamentals of project management through quizzes and self-assessments.

Take 3:

1. Describe the role of project management within organisations and explain its significance in achieving organisational success.
2. Identify the key principles of project management including planning, execution and monitoring.
3. Explain how project management contributes to team skill development within an organisation.
4. Articulate how project management allows organisations to adapt efficiently in a fast-paced business environment.
5. Reflect on and apply project management principles to personal and professional experiences.
6. Identify and apply the SMART principle when setting project goals.
7. Explain the role of requirements in project planning and the potential benefits from successful projects.
8. Identify the core project management processes: initiating, planning, executing, monitoring and controlling, and closing.

9 Apply project management principles to real-world situations.

10 Demonstrate an understanding of the significance of developing clear project objectives and recognising relevant project requirements.

11 Analyse and discuss the relationship between project objectives, project benefits and broader organisational strategy.

12 Use the five key processes of project management to review and evaluate a real-world example project.

Each of these three sets of learning outcomes were mapped against the original list and whilst the numbers of learning outcomes do not match, there is a mapping in each instance.

3.2 Results from the aggregation to improve confidence

A spreadsheet was created from each of the ten runs of the mapping prompt. Each spreadsheet contains the same number of rows (135) and columns (21). A new summary spreadsheet was then created and populated with the aggregated score for each combination of learning resource and learning outcome. From the small sample provided in Table 1, it can be seen that the full range of possible results was obtained.

Table 1. Aggregated mapping score.
Small sample of results from 135 resources and 21 learning outcomes

Name of learning resource	***Energy usage***		
	LO1	***LO2***	***LO3***
Introduction to Energy Management	10	10	0
Smart cities	7	5	8
Smart cities: Principles of sustainable urban planning	5	5	6
Smart cities: Energy efficiency in buildings and urban energy supply	7	8	5
e-learning: energy management in a home	10	10	2

Several project members were asked to review two samples of these results, one learning resource from the high and one from the low scoring ends of the table, once sorted. Table 2 contains the summary of their review. The numbers in the 'other' row were from those who did not feel they could make an assessment. Each of those who disagreed with the ChatGPT result had good reason for doing so.

Table 2. Summary of review findings

Name of learning resource	***Higher ranking***	***Lower ranking***
Agree with ChatGPT result	4	4
Disagree with ChatGPT result	2	1
Other	3	3

4 DISCUSSION

The results from both methods are encouraging. Without including any constraints within the prompt, the triangulation approach produced larger number of learning outcomes than from the original list and this could be seen as problematic, or it could be used to prompt reflection on the detail and balance of the original learning outcomes. In this example we found that there was alignment between the original learning outcomes and each of the three sets generated by ChatGPT from the text. This gives us confidence that the text is focused and no topic has been added or omitted.

The review of the aggregation method suggests it could prove useful when there is sufficient text to consider. The large number of both learning resources reviewed and of learning outcomes made this a challenging task to complete with the limitations with the ChatGPT interface. This regularly only return

a portion of the results and subsequent prompts asking it to continue were then required. Sometimes it would also change the format of the table of results it was producing and some effort was required to bring these altogether. Therefore, if you are considering this approach we recommend it works best on a smaller dataset.

5 CONCLUSION

This paper demonstrates through proof of concept that LLMs can support the alignment and focus of course text on learning outcomes through a triangulation method and can identify and map the coverage of learning outcomes using an aggregation method. In addition, we found that ChatGPT could successfully produce tables mapping learning outcomes and this could prove useful in other aspects of curriculum mapping.

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