

Leveraging Generative AI Tools for Enhanced Lesson Planning in Initial Teacher Education at Post-Primary

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Abstract

The rapid development of generative AI (artificial intelligence) tools such as ChatGPT and Google Bard has opened new possibilities for enhancing lesson planning in initial teacher education (ITE). These tools have the capability to generate tailored educational content, alleviating time constraints while concurrently enhancing the quality of teaching. By simply providing specific requirements and objectives, teachers can obtain comprehensive and well-structured lesson plans and subject plans. This paper explores the potential of generative AI tools to revolutionise lesson planning in initial teacher education. It begins by reviewing lesson planning using a generative AI tool, highlighting the challenges and opportunities that exist. A sample lesson plan and a sample scheme of work are further created. While these tools are revolutionising the way teachers work, these tools will not replace real human teachers. Teachers will always need to supplement generative AI content with their own insights and experience, allowing them to make informed pedagogical decisions.

1. Introduction

The author is a lecturer in education at Hibernia College and combines over twenty years of classroom experience with a passion for the convergence of design, education, and technology. Actively involved across modules for the Professional Master of Education (PME) in post-primary education, he is dedicated to preparing teachers for the future digital classroom, which now includes generative AI. He aims to discern if teachers can efficiently and ethically use generative AI tools for effective lesson planning while also contributing to the ongoing dialogue on innovative integration of technology in the field of education.

AI generative tools, like ChatGPT, are revolutionising the educational landscape (Holmes & Tuomi, 2022). These tools harness advanced algorithms to generate tailored educational content, potentially saving educators valuable time and enhancing instructional quality (NAIN, 2023). In teacher training courses, emphasising the importance of effective lesson plan design equips future educators with the essential skills and knowledge needed to create

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engaging, inclusive, and purposeful learning experiences for their students. It is a foundational element in the development of effective teaching practices and contributes significantly to the overall quality of education (OECD, 2018). However, lesson plans and units of learning take considerable time and effort, especially for new teachers (Su & Yang, 2023). Can these new generative AI tools assist these teachers with this work? Can the tools be used in an ethical way?

Generative AI has the potential to reshape traditional teaching methods (UNESCO, 2023). This short report was focused on exploring the various ways in which generative AI tools can be utilised by pre-service teachers. There are three parts to the report: a review, a sample lesson plan, and a sample scheme of work. The review looked at lesson planning using generative AI tools, highlighting the challenges and opportunities that exist. The sample lesson plan was focused on a lesson for the Leaving Certificate subject, Computer Science. The teaching topic was an introduction to data. The scheme of work was focused on a fifth year group taking the Leaving Certificate Computer Science subject. This was based on one academic year, September to June.

The generative AI tool ChatGPT was used for this report, which was accessed via <https://chat.openai.com>. It was based on a free account using OpenAI's GPT-3.5 architecture. No personal data or copyrighted material was used or entered while using ChatGPT as part of this report.

There were three prompts used for the short report. The first prompt was: *Create a 1500-word report on how generative AI tools can be used by pre-service teachers to create lesson plans. Can you include some references.* The second prompt was: *Create a lesson plan for a secondary school class to introduce computer science data. The class length is one hour long. Please include learning outcomes, learning intentions and success criteria, numeracy, and literacy.* The third prompt was: *Create a scheme of work plan for a fifth year secondary school class for the Leaving Certificate Computer Science subject.* No editing took place after the text was outputted after the prompts.

While the use of the tool was straightforward and caused no issues, the generated text did present some problems. These included:

- Fake references.
- Reduced word count
- A mix of American and English spelling.
- Some repetition in content
- Lack of context awareness. Some responses that were outputted sounded plausible but may not be appropriate in the given classroom context.

These are known challenges that generative AI present to teachers and education practitioners (Stokel-Walker, 2022).

2. AI Generated Short Report

There are three sections to this report: a review, a sample lesson plan, and a sample scheme of work.

(a) Review

1. Introduction

In recent years, the field of education has witnessed a significant transformation due to advancements in technology. One such revolutionary technology is Generative Artificial Intelligence (AI), which has the potential to reshape traditional teaching methods. This report explores the various ways in which generative AI tools can be utilized by pre-service teachers to create effective and innovative lesson plans. By leveraging these tools, pre-service teachers can enhance their teaching strategies, engage students, and adapt to the ever-changing educational landscape.

2. Understanding Generative AI Tools

Generative AI refers to the capability of artificial intelligence systems to generate new content, such as text, images, or even videos, based on patterns and data it has been trained on. These tools utilize algorithms, neural networks, and deep learning techniques to create content that is often indistinguishable from human-generated content.

3. Benefits of Generative AI in Lesson Planning

3.1 Personalized Learning:

Generative AI tools can analyze students' learning styles, preferences, and abilities, enabling pre-service teachers to tailor their lesson plans to individual student needs. This personalized approach enhances student engagement and comprehension, making learning more effective.

3.2 Creativity Enhancement:

AI-generated content can spark creativity among pre-service teachers. By providing them with diverse and innovative teaching materials, these tools inspire teachers to design lessons that are both informative and creative, capturing students' attention and encouraging active participation.

3.3 Time Efficiency:

Generative AI tools can automate the process of creating lesson plans. By generating content, suggesting teaching methodologies, and even assessing learning outcomes, these tools significantly reduce the time pre-service teachers spend on planning, allowing them to focus on other essential aspects of their professional development.

4. Challenges and Ethical Considerations

4.1 Quality Control:

While generative AI tools offer vast potential, ensuring the accuracy and reliability of generated content is crucial. Pre-service teachers must critically evaluate the output and cross-reference it with authoritative sources to maintain the quality of their lesson plans.

4.2 Ethical Use:

Pre-service teachers need to be aware of the ethical implications of using AI-generated content. They must understand the limitations and biases within the algorithms, ensuring that the materials created are inclusive, unbiased, and respectful of diverse cultures and backgrounds.

5. Integrating Generative AI Tools into Teacher Education Programs

5.1 Curriculum Integration:

Teacher education programs should incorporate modules that teach pre-service teachers how to effectively use generative AI tools. These modules can cover topics such as understanding AI algorithms, evaluating AI-generated content, and integrating AI tools into diverse subjects and grade levels.

5.2 Hands-on Training:

Providing hands-on training with various generative AI platforms enables pre-service teachers to gain practical experience. Workshops, webinars, and interactive sessions can empower them to explore the full potential of these tools in designing engaging lesson plans.

5.3 Collaboration with Tech Experts:

Collaboration between teacher education institutions and technology experts is essential. By fostering partnerships with AI developers, educational institutions can stay updated with the latest advancements, ensuring that pre-service teachers are trained on cutting-edge AI tools.

6. Case Studies and Best Practices

6.1 Case Study 1: Interactive Language Learning

A pre-service language teacher uses generative AI tools to create interactive language learning modules. These modules incorporate AI-generated conversations, pronunciation guides, and language exercises tailored to individual students' proficiency levels, enhancing their language skills effectively.

6.2 Case Study 2: Adaptive Mathematics Lessons

A pre-service math teacher utilizes generative AI algorithms to analyze students' mathematical abilities. Based on this analysis, the AI tool generates adaptive mathematics lessons that target specific areas where students need improvement. This personalized approach leads to enhanced understanding and improved academic performance.

7. Conclusion

Generative AI tools have immense potential in revolutionizing the way pre-service teachers create lesson plans. By embracing these technologies, educators can foster personalized learning, enhance creativity, and optimize their time and effort. However, it is essential to address challenges such as quality control and ethical considerations to ensure responsible use. Integrating generative AI tools into teacher education programs, providing practical training, and fostering collaborations with technology experts are key steps toward preparing future educators for the AI-driven educational landscape.

References:

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(b) Sample Lesson Plan:

Lesson Plan: Introduction to Computer Data

Grade Level: Secondary School (9th Grade)

Subject: Computer Science

Duration: 1 hour

Learning Outcome:

By the end of the lesson, students will understand the concept of computer data, differentiate between various types of data, and recognize the importance of data in computer science and real-life applications.

Learning Objectives:

- Define computer data and its significance.
- Differentiate between qualitative and quantitative data.
- Identify examples of computer data in everyday scenarios.
- Explain the relevance of data in computer science and its applications.

Success Criteria:

- Students can accurately define computer data.
- Students can provide examples of qualitative and quantitative data.
- Students can recognize and explain the importance of data in computer science.

Literacy and Numeracy Integration:**Literacy:**

- Reading: Students will read short passages related to different types of computer data.
- Writing: Students will write down examples of data types discussed during the lesson.
- Speaking: Students will participate in class discussions, explaining their understanding of data concepts.

Numeracy:

- Students will engage in activities involving numerical data, understanding the difference between numerical data and other types of data.
- Students will interpret charts and graphs related to real-life data examples.

Lesson Outline:

Introduction (15 minutes)

Engagement (5 minutes): Begin with a short video or real-life examples demonstrating the significance of data in everyday life. Discuss examples like weather forecasts, sports statistics, and social media trends.

Definition and Types of Data (10 minutes): Define computer data as information in a form suitable for use with a computer. Introduce qualitative data (descriptive, categorical) and quantitative data (numerical). Provide examples for each type.

Activity: Data Classification (20 minutes)

Group Activity (10 minutes): Divide students into small groups. Provide each group with a set of data examples (both qualitative and quantitative). Groups categorize the data and present their classifications to the class. Encourage discussions on why certain data fits into specific categories.

Class Discussion (10 minutes): Discuss the classifications made by each group. Clarify any misconceptions and emphasize the importance of accurate data classification in computer science.

Application and Real-Life Relevance (15 minutes)

Interactive Activity (10 minutes): Engage students in an interactive activity involving real-life data representation. Show a graph or chart related to a current event or topic. Discuss the data represented and its implications. Ask students to interpret the data and draw conclusions.

Class Discussion (5 minutes): Facilitate a discussion about the importance of accurate data representation and analysis in making informed decisions, both in computer science and in everyday life.

Conclusion (10 minutes)

Recap and Review (5 minutes): Summarize key points about data types, classification, and real-life applications discussed during the lesson. Ask students questions to reinforce their understanding.

Reflection (5 minutes): Have students write a short reflection on what they have learned about computer data and its significance. Encourage them to relate the lesson to real-life situations they encounter regularly.

Assessment:

Formative Assessment: Monitor group discussions and class participation. Evaluate students' ability to classify data accurately and participate in discussions.

Summative Assessment: Evaluate students' written reflections on the lesson, focusing on their understanding of data concepts and their relevance in computer science and real-life contexts.

Homework (Optional):

Assign a small research task where students find examples of data application in a specific field of interest (e.g., healthcare, environment, technology) and present their findings in the next class.

Note:

This lesson plan provides a comprehensive introduction to computer data, integrating literacy and numeracy skills while emphasizing the practical relevance of data concepts in both computer science and everyday life.

(c) Sample of a Scheme of Work Plan:

Scheme of Work Plan for Leaving Certificate Computer Science (5th Year Secondary Class)

Duration: One Academic Year (September to June)

Term 1: September - December

Weeks 1-2: Introduction to Computer Science

- Understanding the basics of computer science
- History and evolution of computers
- Introduction to programming languages

Weeks 3-6: Programming Fundamentals

- Introduction to algorithms and problem-solving strategies
- Basics of Python programming language
- Variables, data types, and operators
- Control structures: loops and conditionals

Weeks 7-10: Data Representation and Number Systems

- Binary, octal, decimal, and hexadecimal number systems
- Converting between different number systems
- Representing characters and images using binary data
- Introduction to ASCII and Unicode

Term 2: January - March

Weeks 1-4: Computer Systems

- Components of a computer system: CPU, memory, storage, input/output devices
- Operating systems and utility software
- Computer networks, internet, and cybersecurity basics
- Cloud computing and its applications

Weeks 5-8: Databases and SQL

- Introduction to databases and data models
- Basics of Structured Query Language (SQL)
- Creating, querying, and modifying databases using SQL
- Database design principles

Weeks 9-10: Project Management and Software Development

- Introduction to project management concepts
- Software development life cycle: planning, analysis, design, implementation, testing, deployment
- Version control systems and collaborative coding tools

Term 3: April – June

Weeks 1-3: Web Development

- Introduction to web technologies: HTML, CSS, JavaScript
- Designing and creating static web pages
- Introduction to dynamic web content and interactivity

Weeks 4-6: Algorithms and Computational Thinking

- Sorting and searching algorithms: bubble sort, quicksort, binary search
- Introduction to computational thinking and problem-solving techniques
- Algorithm efficiency and complexity analysis
- Recursion and its applications

Weeks 7-10: Ethical and Legal Issues in Computing

- Copyright, intellectual property, and software licenses
- Privacy concerns and data protection laws
- Cybersecurity ethics and online safety
- Social and ethical implications of emerging technologies

Assessment and Revision:

- Regular quizzes, assignments, and coding exercises to assess student understanding.
- Mid-term and end-of-term examinations to evaluate knowledge retention and application.
- Revision sessions and mock exams to prepare students for the Leaving Certificate Computer Science exam.

Note:

This scheme of work plan provides a structured outline for teaching Leaving Certificate Computer Science to 5th-year secondary students. It is flexible and can be adapted based on the students' pace of learning and the specific curriculum requirements of the school. Regular assessment and revision are crucial to ensure students are well-prepared for the final examination.

3. Critical Reflection

3.1 Reflections on Process

The aim of the research was to investigate if generative AI tools such as ChatGPT could be used successfully to create content for teachers such as lesson plans and subject plans. This was focused on work that is not assessed within the two-year Professional Master of Education program. There were three parts to the report: the review, a sample lesson plan, and a sample scheme of work. The sample lesson plan was focused on the Leaving Certificate subject, Computer Science. The topic was an introduction to data. The scheme of work was focused on a fifth year group taking Leaving Certificate Computer Science as a subject over one academic year. The report was broad but made some valid points about the benefits of generative AI in lesson planning. It also discussed the challenges and ethical considerations as well as some suggestions about integrating generative AI tools into teacher education programs. As expected, the references were not valid and did create some confusion, as they appear to be real. The suggested word count fell short and there were some repetition with content. The lesson plan had a good structure and had broken the lesson in suitable components for both the teacher and students. The learning objectives were clear and broken down:

- Define computer data and its significance.
- Differentiate between qualitative and quantitative data.
- Identify examples of computer data in everyday scenarios.
- Explain the relevance of data in computer science and its applications.

The success criteria were also clear and broken down:

- Students can accurately define computer data.
- Students can provide examples of qualitative and quantitative data.
- Students can recognise and explain the importance of data in computer science.

Literacy and numeracy were discussed with some approaches explained. There were suitable examples given in relation to how the topic of data could be visualised. Further editing would be required by the teacher, as there was a mix of American and English spelling and some repetition. There was a lack of context awareness in some sections. Some of the responses that were outputted sounded plausible but may not be appropriate in the given context of a classroom.

Overall, the output could be used in the classroom by the teacher after some edits. The lesson plan gave teachers the option to add their own resources and their own approach to the topic. Additional areas such as differentiation and Universal Design for Learning (UDL) (CAST, 2018) could also have been a good addition to the lesson plan. The scheme of work did input some unnecessary topics, but it was successful in mapping out a plan for the subject within the time frame specified. Overall, to conclude, generative AI tools have immense potential in helping teachers create lesson plans and schemes of work. By embracing these technologies, educators can foster creativity in teaching and learning and optimise time and effort. However, it is essential to address challenges such as quality control and ethical considerations to ensure responsible use for these generative AI tools (Southworth & Migliaccio, 2023).

In terms of the time taken to complete the process, it took less than twenty minutes. Most of this time was spent deciding on the prompts and what the focus was going to be. The actual

time for the generated text to be completed was less than a minute per prompt. Overall, it was very fast, with no waiting time to get access to the application, ChatGPT.

If the process were to be repeated, more time would be spent defining the prompts away from the actual application. It is felt this would result in more focused prompts. The more planned and specific prompts that are used result in better outputs.

Overall, it was not difficult to write the short report with generative AI. The ability to increase word count and better accuracy with references could be improved as the technology grows in the future.

3.2 Reflection on Implications:

The implications for knowledge, scholarship, teaching and learning, and assessment are huge. In terms of teacher training and the future, teachers need to be not only be aware of these new cutting-edge technologies, but they need to be fluent in using them in their classroom. There needs to be an AI literacy guide for future teachers to prepare them for this new classroom. There is often confusion with AI benefits and what it can be used for (Antonenko & Abramowitz, 2023). Not only could they save time and effort with planning and administration, but it will have an impact on the teaching, learning and assessment going forward, including new creative ways to use the technology (Nerantzi et al., 2023).

To conclude, there are no easy answers to this new technology and the role it can play for future teachers in the classroom. Teachers need to know how to use these new tools in an ethical way. We need to remember though, these are only tools, and the actual human teacher, will also be needed for success in teaching, learning and assessment. In terms of use within initial teacher education (ITE), guidance and future solutions will depend on the context and educational institution in question.

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