

Beyond the Classroom: Utilizing Large Language Models to Propel External Learning

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Abstract. External learning, occurring outside traditional classrooms, emphasizes learner autonomy, flexibility, lifelong learning, critical thinking, and networking. However, it also presents challenges such as limited structure, resource access issues, isolation, distractions, progress assessment difficulties, credibility recognition gaps, and technology barriers exacerbated by the digital divide. With new technologies and innovative methods constantly emerging in the world of education, one such recent development is the use of large language models as a facilitator of learning outside the classroom. To enhance the external learning experience, a workflow incorporating AI tools like Language Model Large (LLM) is proposed. This workflow spans goal setting, curriculum curation, interactive learning sessions, and progress tracking, leveraging LLM capabilities to personalize the learning journey, curate relevant resources, facilitate interactive engagement, and provide real-time feedback. This paper examines the utilization of LLM by presenting the application of LLM in different external learning scenarios.

Keywords: External learning, Large Language Model, Education Digitalization

1 Introduction

As technology continuously evolves and global informatization deepens, the field of education is undergoing unprecedented transformations. Within this revolution, Large Language Models (LLMs)[5], as an emerging AI technology, are gradually unveiling their immense potential and value in education. Specifically, in the domain of External Learning[7], LLMs not only offer students richer and more diverse learning resources but also fundamentally transform their learning approaches and experiences.

External Learning refers to learning activities undertaken by students outside of formal school curriculums, including self-directed learning, online courses, community service, and more. With shifting educational paradigms and technological advancements, the importance of External Learning has become increasingly prominent. Traditional school-based learning is often constrained by time, space, and educational resources, whereas External Learning provides a broader learning landscape and a more varied array of resources. This approach fosters students' autonomy, innovation, and lifelong learning capabilities.

However, External Learning faces numerous challenges. Firstly, students often lack systematic guidance and supervision in this learning environment, leading to issues such as unclear learning

objectives or inappropriate learning methods. Secondly, the resources available for External Learning are vast and vary widely in quality, requiring students to possess high levels of information screening and integration skills. Finally, effective assessment and feedback mechanisms for External Learning are complicated to conduct with teacher, making it difficult for students to accurately gauge their progress and outcomes.

A Large Language Model (LLM) is a type of natural language processing (NLP)[2] model that has been trained on vast amounts of text data to recognize and generate human language. These models are capable of understanding and producing responses to a wide range of language-based tasks, including text classification, summarization, translation, and even generating entirely new text that is coherent and contextually relevant. Large Language Models (LLMs) have numerous potential applications in education. These include personalized learning[5], where LLMs analyze students' writing or speech patterns to tailor resources or feedback; content creation, allowing teachers to quickly generate engaging lesson plans[1], quizzes, and personalized materials[8]; language learning, where LLMs serve as virtual tutors providing real-time feedback[3]; accessibility, offering alternative ways for students with learning difficulties to access and understand complex concepts[4]; and automated grading, freeing up teachers' time[6]. Overall, LLMs have the potential to transform education by enhancing personalization, efficiency, and accessibility for all students.

This study aims to explore how LLM can propel the development and innovation of External Learning. Specifically, we will investigate how LLMs can offer more personalized and efficient resource recommendations and learning guidance to students, as well as how they can provide more accurate and comprehensive assessments and feedback on learning outcomes. Through this research, we aspire to contribute new insights and methodologies to the advancement of External Learning and, concurrently, to the informatization and intelligentization of education.

Through this study, we anticipate achieving the following research outcomes and contributions: Firstly, the paper contributes to the growing understanding of the complexities and potential of external learning, offering practical insights and strategies for learners and educators alike. By acknowledging both the imperatives and confinements of this mode of learning, and proposing innovative solutions such as the integration of AI tools, the paper paves the way for a more inclusive, flexible, and effective approach to lifelong learning. Secondly, the paper proposes an external learning workflow incorporating a Language Model Large (LLM) or a similar AI tool. This workflow aims to enhance the learner's experience by providing structure, guidance, and resources tailored to their individual needs and goals. Through goal setting and planning, curriculum and content curation, and interactive learning sessions, the LLM supports external learners in clarifying their learning objectives, accessing relevant resources, and engaging with the content in a meaningful and productive way. Finally, to further elaborate on the paper's contribution, we will demonstrate how the external learning workflow can be seamlessly integrated with a Large Language Model (LLM). This integration allows for a more dynamic and efficient exchange of information, enhancing the overall capabilities of the LLM. To provide a concrete example of this integration, we have conducted an experiment that will be presented through a series of question-and-answer cases.

2 Imperatives and Confinements of Learning Externally

External learning comes with its own set of needs and limitations. Imperatives and confinements of learning externally refer to the essential requirements and limitations that arise when individuals engage in learning activities outside of a traditional classroom or formal educational setting. These aspects often shape the learning experience and can present both opportunities and challenges for learners.

2.1 Imperatives of learning externally

These imperatives emphasize the learner's agency, autonomy, and responsibility in managing their own learning process. Here are some key imperatives of learning externally:

Flexibility and autonomy. External learning often demands a flexible approach, allowing learners to determine their own pace, time, and place of study. This autonomy is crucial for accommodating different lifestyles and learning preferences.

Lifelong learning. External learning often aligns with the principles of lifelong learning, encouraging individuals to continue developing their knowledge and skills throughout their lives, enabling individuals to adapt to evolving demands, beyond the confines of formal education.

Critical thinking. External learning environments often promote critical thinking skills as learners encounter diverse perspectives and are encouraged to evaluate information critically, synthesize knowledge from multiple sources, and apply it to real-world problems.

Networking and collaboration. Building networks and collaborating with others becomes an imperative in external learning, as it allows learners to tap into a wider pool of knowledge, resources, and support systems.

2.2 Confinements of learning externally

Contrastly, here are some key imperatives of learning externally:

Limited structure and guidance. Unlike traditional classrooms, external learning environments may offer less structure and instructor support. This can pose challenges for learners who require more direction or struggle with self-motivation.

Lack of access to resources. While the internet provides vast resources for learning, access to reliable and high-quality materials can still be limited, especially for learners in rural or underserved areas with limited connectivity.

Isolation and Lack of Social Interaction. Learning externally may lead to feelings of isolation or loneliness, especially if learners are not actively engaged in online communities or other forms of social learning, affecting motivation.

Distractions. The freedom and flexibility of external learning can also be a double-edged sword. Without a set schedule or classroom environment, learners may find it difficult to manage their time effectively and avoid distractions that can hinder their learning progress.

Difficulty in assessing progress. Without regular assessments or feedback from teachers or peers, external learners may find it difficult to accurately assess their own progress and identify areas where additional focus or support is needed.

Lack of credibility and recognition. Obtaining recognition for externally acquired skills and knowledge can be a confinement, especially in formal settings where traditional degrees or certificates are still highly valued.

Digital divide and technology barriers. The digital divide, referring to the unequal distribution of technology access and proficiency across different demographics, can pose a significant confinement for some external learners. Not everyone has equal access to technology or the necessary skills to use it effectively for learning purposes. This digital divide can create barriers to external learning for certain populations.

3 External Learning Workflow

To mitigate the imperatives and confinements of learning externally, an external learning workflow incorporating a Language Model Large or a similar AI tool can be designed to enhance the learner's experience and provide structure, guidance, and resources. Here's an example of such a workflow:

Goal Setting and Planning: The learner starts by defining clear learning goals and objectives. LLMs can assist learners in clarifying their learning goals by providing examples, suggestions. Using the LLM, they can generate a personalized study plan that breaks down the learning process into manageable chunks and sets realistic deadlines.

Curriculum and Content Curation: The LLM assists in curating relevant learning resources, such as online courses, articles, videos, podcasts, and textbooks, based on the learner's interests and goals. Using LLMs, learners can access vast amounts of information and have it filtered or summarized to focus on the most relevant and useful content for their learning objectives. It can also recommend a structured learning path by sequencing these resources in an optimal order, suggesting additional resources based on the learner's interests and progress.

Interactive Learning Sessions: The learner engages with the content through question-and-answer sessions, enabling interactive learning experiences like role-playing exercises.

The LLM provides real-time feedback, answers questions, and clarifies concepts to enhance understanding, which helps learners identify gaps in their understanding and areas for improvement.

Progress Tracking and Assessment: The workflow includes regular assessments to evaluate the learner's progress and understanding. By analyzing learners' interactions with the workflow, LLMs can identify areas where learners might be struggling and offer tailored support or remediation. The LLM administers these assessments, monitors learners' progress over time and provides regular updates and detailed feedbacks on their performance, and identifies areas for improvement or further focus.

Social Learning and Collaboration: To mitigate isolation, the workflow incorporates social learning elements, such as discussion forums or study groups. The LLM can facilitate these

interactions by guiding discussions, suggesting relevant resources, or connecting learners with peers who share similar interests.

Adaptive Personalized Learning: The LLM continuously monitors the learner's performance and adjusts the learning path accordingly, deliver personalized feedback to learners based on their progress and providing more challenging or remedial content as needed. It personalizes the learning experience by recommending content and suggesting alternative approaches to learning based on the learner's preferences, learning style, and pace.

The workflow ensures that LLM is integrated seamlessly and accessible to all learners, especially the external. The LLM interfaces with various platforms and tools to provide a unified learning experience across devices and modalities, which naturally shortens digital divide between school and outside.

By incorporating an LLM into an external learning workflow, learners can benefit from personalized guidance, structured learning paths, interactive sessions, real-time feedback, progress tracking, social learning opportunities, adaptive learning experiences, and accessible technology integration. This approach helps to mitigate the confinements of learning externally by providing the necessary support and resources to foster an effective and engaging learning environment.

4 Case Show

To illustrate how the external learning workflow incorporated with LLM, our experiment will be displayed as question-and-answer cases in appendix. These cases will showcase how the external learning workflow complements the LLM by introducing new knowledge and perspectives. Each question will represent a challenge or scenario faced by the LLM, while the answer will highlight how the external learning workflow has enabled the LLM to overcome these challenges and provide more comprehensive responses.

The following cases illustrate how LLMs can be seamlessly integrated into external learning workflows to clarify concepts, recommend resources, track progress, and give feedback. Whether it's a student struggling with a biology concept, a language learner assessing their progress, or someone seeking personalized mentoring in math, LLMs have the potential to transform the way we learn and grow.

Case 1: Content Clarification

In this scenario, a student preparing for a biology exam seeks clarification on the concept of mitosis. The LLM-based system provides a concise yet comprehensive explanation of the process, including its stages and the role of chromosome replication. This not only helps the student understand the concept better but also reinforces their learning by providing a clear and structured overview.

Case 2: Personalized Feedback and Mentoring

In this case, a student struggling with math homework receives personalized feedback and mentoring from the LLM-based system. By breaking down the problem into smaller steps and

offering alternative approaches, the system helps the student overcome their specific challenges and gain a deeper understanding of the mathematical concepts involved.

Case 3: Content Curation and Suggestions

An individual interested in learning more about artificial intelligence asks for resource recommendations. The LLM-based system provides a curated list of books, online courses, and blogs that cover a wide range of AI topics. This not only helps the learner dive deeper into the subject but also exposes them to different perspectives and viewpoints.

Case 4: Practice and Feedback

A Spanish language learner practices their vocabulary with the help of an LLM-based system. The system provides practice sentences and immediate feedback on the learner's usage of words. This interactive approach helps the learner gain confidence in their language skills and identifies areas where additional practice is needed.

Case 5: Progress Tracking

A student preparing for a math test wants to track their progress. The LLM-based system analyzes the student's interactions with learning materials and practice questions to provide insights into their understanding and areas needing improvement. This allows the learner to focus their efforts on specific areas and maximize their learning efficiency.

Overall, these cases demonstrate the versatility and potential of LLMs in enhancing external learning experiences. By leveraging the power of these advanced AI systems, learners can clarify concepts, assess progress, receive personalized feedback, and discover valuable resources on their path to knowledge and skill mastery.

By presenting our findings in this format, we aim to offer a clear and engaging demonstration of the potential benefits of combining external learning workflows with LLMs. We believe that this approach will not only enhance the understanding of this complex topic but also inspire further exploration and innovation in the field.

5 Conclusions and Future Work

As artificial intelligence technology continually evolves and gains popularity, Large Language Model will play an increasingly pivotal role in education. We have specifically examined how LLMs can offer personalized and efficient resource recommendations, learning guidance, and provide more precise and comprehensive learning outcomes assessments and feedback in External Learning. Our research aspires to propel the advancement of External Learning, aligning with the growing trend of education's informatization and intelligentization.

This study serves as a preliminary exploration of the applications of Large Language Models in the domain of External Learning, with much work still ahead. For instance, further research can delve into how to leverage Large Language Models for more intelligent and personalized learning resource recommendations and guidance or how to integrate them with other educational technologies such as virtual reality or augmented reality to provide more immersive and interactive learning experiences for students. Additionally, it is imperative to address ethical and privacy issues that may arise from the application of Large Language Models in education.

We are confident that with continuous technological advancements and innovations, Large Language Models will bring about profound impacts and transformations to the field of education. We eagerly await these developments.

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Appendix

Case 1: Content Clarification

Question from the learner:

"I'm studying for my biology exam, and I'm having trouble understanding the concept of mitosis. Can you explain it to me?"

Answer from the LLM-based system:

"Mitosis is a process of cell division in which a single cell divides into two identical daughter cells. It involves several stages, including prophase, metaphase, anaphase, and telophase. During mitosis, the cell's chromosomes replicate and then separate into two identical sets, which are distributed evenly between the two new cells. This process ensures that each daughter cell receives the same genetic information as the original cell."

Case 2: Personalized Feedback and Mentoring

Question from the learner:

"I'm struggling with my math homework. Can you help me figure out this problem?"

Answer from the LLM-based system:

"Sure, I can help you with that. First, let's break down the problem into smaller steps. Can you tell me what part of the problem you're having trouble with?"

(After the learner explains the specific issue)

"Okay, I see where you're getting stuck. Let's try approaching the problem from a different angle. Instead of trying to solve it all at once, let's tackle each step individually. Here's how we can do it..."

Case 3: Content Curation and Suggestions

Question from the learner:

"I'm interested in learning more about artificial intelligence. Can you recommend some resources?"

Answer from the LLM-based system:

"Absolutely! Here are a few resources that you might find helpful:

1. 'Artificial Intelligence: A Modern Approach' by Stuart Russell and Peter Norvig - This is a classic textbook that covers the fundamentals of AI.

2. 'Deep Learning' by Ian Goodfellow, Yoshua Bengio, and Aaron Courville - This book delves into the mathematical and conceptual underpinnings of deep learning.
3. 'Machine Learning' by Tom Mitchell - Another excellent textbook that covers a wide range of machine learning topics.
4. Online courses on platforms like Coursera or edX - These platforms offer a variety of AI-related courses taught by leading experts in the field.

Case 4: Practice and Feedback

Question from the learner:

"I'm practicing my Spanish vocabulary, but I'm not sure if I'm using the words correctly. Can you help me?"

Answer from the LLM-based system:

"Of course! Let's try some practice sentences. How would you say 'I like to read books' in Spanish?"

Question from the learner:

"Me gusta leer libros."

Answer from the LLM-based system:

"That's correct! Good job! Let's try another one. How about 'She speaks three languages'?"

Question from the learner:

"Ella habla tres idiomas."

Answer from the LLM-based system:

"Perfect! You're doing well with your Spanish vocabulary."

These cases demonstrate how LLMs can be used to clarify concepts, recommend resources, provide practice opportunities, and give feedback to learners in an external learning workflow. By leveraging the capabilities of LLMs, learners can enhance their understanding, expand their knowledge, and improve their skills more effectively.

Case 5: Progress Tracking

Question from the learner:

"I've been studying for my math test for the past week. How am I doing?"

Answer from the LLM-based system:

"Based on your past interactions with the learning materials and practice questions, it appears that you have a good understanding of the concepts. However, there are a few areas where you might need additional practice. Let's focus on those areas and see if we can improve your understanding."

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