Flipping the Script: Neuroscientific Insights into Flipped Learning

Maria Teresa Martinez Garcia
University of Valladolid, Valladolid, Spain

Daniela Trinks
Myongji University, Yongin, Korea

This study investigates the impact of flipped learning (FL) on EFL instruction and the role of neuroscience in advancing this approach. FL involves students engaging with course content independently before participating in interactive classroom activities. By aligning FL with neuroscientific principles, educators can create environments that improve cognitive processes and learning outcomes. A case study conducted at a Korean university revealed that FL addresses diverse proficiency levels and increases engagement, promoting effective learning. The research highlights the need for further investigation into the potential of FL to optimize EFL instruction through a neuroscience-informed approach.

INTRODUCTION

Flipped learning (FL), an educational approach where students explore the class content independently before engaging in learning activities in the classroom, has gained significant traction in recent years (Bergmann & Sams, 2014; FLGI, 2024). While the benefits of flipped learning have been documented through educational research, neuroscience offers a deeper understanding of why this approach can be so effective. By examining how the brain learns and retains information, we can create flipped classroom environments that optimize cognitive processes and improve student outcomes.

This study explores the intersection of neuroscience and flipped learning, highlighting how specific neurological principles can inform the design and implementation of flipped classrooms, and providing a case study to better understand students' responses to this type of learning. The panel discussion "Bridging the Gap: Blending Online with Offline Teaching in Language Education" featured contributions from the authors who covered neuroscience in language education and flipped learning, alongside three other panelists: Sarah Slagle, Reece Randall, and Rhett Burton, with Victor Reese as the moderator. Each presenter offered a ten-minute talk, providing diverse insights into blended learning. Burton discussed his approach to private English education for young learners, Slagle explored challenges and solutions for limiting AI usage in higher education, and Randall emphasized the importance of teachers engaging in professional development to keep up with technological advancements and adapting their teaching strategies.

FLIPPED EFL CLASSROOM: INSIGHTS FROM A CASE STUDY

During Covid, all teachers were suddenly urged to transfer from offline to online teaching. Instructors had to suddenly learn many technological skills, such as video lecture recording, editing, and managing live online classes. Returning to in-person teaching in 2021 provided the opportunity to reflect on both online and offline teaching and investigate new teaching methods, such as flipped learning, which attempts to combine the strengths of both approaches.

For many EFL teachers, the greatest challenge lies in addressing the wide range of English proficiency levels among learners. Tailoring lessons or materials to match the diverse skill levels is often nearly impossible, resulting in some students feeling excluded and the class becoming less relevant to them. Flipped learning offers a potential solution to bridge this gap. However, it is important to understand that FL involves more than just having students watch recorded lessons before class and continue their learning in the classroom. It encompasses a broader approach that includes interactive, student-centered activities designed to enhance engagement and deepen understanding.

When introducing new educational approaches, it is essential to explain the rationale behind employing new methods and technologies in the classroom. In FL, an orientation session is ideal for briefly introducing the class method and highlighting its benefits, such as allowing students to learn at their own pace, at their preferred time and place, by watching recorded lecture videos. This approach enables teachers to facilitate learning and provide timely assistance and feedback during in-class practice, allowing all students to engage in activities regardless of their proficiency levels. Additionally, it is crucial to emphasize the importance of fulfilling pre-class requirements, like watching lecture videos to avoid reduced attendance points and to ensure effective learning outcomes during class practice. Another effective technique is administering weekly vocabulary tests based on the words taught in the video lessons. Using a vocabulary learning app like Quizlet to provide the vocabulary list for each class can further aid students in their preparation.

After making use of the FL method for two years, we conducted a study to evaluate its success from the learners' perspective. Due to length constraints, more detailed results of this case study cannot be fully described in this manuscript, and we will focus on highlighting the strengths and weaknesses of flipped learning in an EFL university classroom. Seventeen students from a major EFL class at a Korean university participated, including 15 Korean and 2 Chinese students, with 15 males and 2 females. They reported their English proficiency levels as 37.5% basic, 37.5% intermediate, 18.75% beginner, and 6.25% advanced. When asked about their preference, 81% favored the FL method over traditional teaching for this EFL course, and 75% expressed a desire for FL to be applied to other subjects beyond English language learning. Despite this clear preference for the new approach, it is important to acknowledge and address some of its shortcomings.

When asked about their preferred length for video lectures, students showed no consensus: 50% preferred lectures of 30 minutes or less, while the other 50% favored lectures longer than 30 minutes. Additionally, students were asked to evaluate suggested improvements. Among the responses, 56% preferred a bilingual approach, 44% requested Korean subtitles, and 25% wanted English subtitles. These findings indicate that incorporating native language support, such as subtitles, can improve learning effectiveness compared to a solely English lecture without subtitle options.

Based on the survey results, we implemented several improvements in the course. We divided the lectures into segments of 15 minutes or less and named each segment specifically to

facilitate selective review during exam preparation. Additionally, we uploaded the video lectures on YouTube and edited the automatic English subtitles, allowing students to enable Korean or Chinese subtitles if needed. For in-person classes, weekly vocabulary tests were conducted on previously studied words to ensure students were familiar with new terms, enhancing their engagement in subsequent reading, listening, writing, and speaking exercises. We also reviewed grammar bilingually in class, followed by exercises with the teacher providing individual feedback.

In summary, this case study indicates that flipped learning holds significant potential for enhancing EFL learning, particularly in classes with diverse proficiency levels. By reducing direct teaching to concise lecture videos, students can choose when, where, and how often to watch them, with the option to use subtitles. The in-person classroom sessions are student-centered, emphasizing minimal direct teaching while prioritizing exercises and individual feedback. However, due to the small sample size, more research is needed to expand on the results of this case study.

NEUROSCIENCE AND FLIPPED CLASSROOMS

One of the core strengths of flipped learning lies in its emphasis on prior knowledge. In this regard, neuroscience tells us that learning involves the formation of new neural connections, or synapses, between neurons in the brain. When students encounter new information, these connections are weak and require reinforcement to become permanent. Flipped classrooms address this by having students engage with introductory content outside of class, often through video lectures, readings, or online resources. This independent learning allows students to build a foundational understanding at their own pace. During class time, the instructor can then focus on deepening this understanding by using active learning strategies such as discussions, problem-solving activities, and collaborative projects. This approach aligns with the concept of spaced repetition, a learning strategy that involves revisiting information at spaced intervals to strengthen neural connections (for a review, see Rohrer & Taylor, 2007). By encountering key concepts before and during class, students are more likely to retain the information and build stronger neural networks (Bahrick & Popovic, 2006).

Flipped learning goes beyond simply delivering content and emphasizes active learning in the classroom. This shift is crucial from a neurological perspective. The prefrontal cortex (PFC) is the brain region responsible for higher-order thinking skills such as critical analysis, problem-solving, and decision-making (Diamond, 2004). During passive learning activities like lectures, the PFC is less engaged, leading to weaker memory consolidation. In contrast, flipped classrooms promote active learning by encouraging students to apply their knowledge through discussions, group work, and hands-on activities. These activities stimulate the PFC, fostering deeper understanding and encouraging students to make connections between new and existing knowledge. Studies have shown that active learning can lead to increased student engagement, improved problem-solving skills, and better retention of information (Prince, 2004). This aligns with the neuroscientific understanding of the PFC, suggesting that flipped classrooms create an environment that optimizes the brain's natural learning processes.

Flipped learning also provides opportunities for consolidation and retrieval, both vital for long-term memory formation. Consolidation refers to the process by which short-term memories

are transformed into long-term memories through repeated exposure and practice (McClelland et al., 1995). Retrieval, the act of bringing information back to mind, further strengthens memory pathways and aids in future recall (Karpicke & Roediger, 2008). Flipped classrooms facilitate consolidation by allowing students to revisit key concepts through homework assignments, quizzes, or discussions in class. Retrieval is promoted by activities that require students to apply their knowledge in new contexts, such as problem-solving exercises or open-ended discussions. These exercises activate the brain's memory networks, making it easier for students to access and retain information in the long term.

While neuroscience offers a compelling case for flipped learning, it is important to acknowledge potential challenges. Students with varying learning styles or prior knowledge levels may struggle with independent learning outside of class. To address this, flipped classrooms should incorporate scaffolding techniques, which provide temporary support to help students complete tasks until they can do so independently (Wood et al., 1975). This might involve providing additional resources, breaking down complex concepts into smaller steps, or offering opportunities for peer collaboration. Furthermore, neuroscience emphasizes the importance of differentiation in educational settings (Pascarella & Terenzini, 2005). Different students have different learning needs and cognitive strengths. Flipped classrooms should provide options for students to engage with content in ways that resonate with them. This could involve offering a variety of learning materials in different formats (e.g., text, video, audio) or allowing students to choose the activities that best suit their learning styles.

CONCLUSIONS

Neuroscience elucidates the mechanisms of brain learning, facilitating the development of flipped classrooms that optimize cognitive processes. Comparable to a symphony, flipped learning orchestrates various elements to foster a productive environment. When integrated with students' perspectives and opinions, it has the potential to create an ideal learning setting. Independent study lays the groundwork for foundational knowledge, priming students for deeper engagement. Active learning strategies build upon this foundation, enhancing comprehension and promoting long-term retention. By recognizing individual learning styles and offering tailored support, flipped classrooms ensure inclusive participation. Despite inherent challenges, the application of brain-based principles can yield dynamic and effective educational experiences. The findings of this study demonstrate how flipped learning can enhance EFL teaching while highlighting the need for more research to add to these findings.

THE AUTHORS

Maria Teresa Martinez Garcia, PhD, is an associate professor in the English Department at the University of Valladolid, Spain. She specializes in teaching advanced English and linguistics courses. Her research focuses on speech perception, language acquisition, and innovative pedagogical approaches to language instruction. Email: mtmg87@gmail.com

Daniela Trinks, PhD, is a professor in the Department of Go Studies at Myongji University where she has been teaching Go English, culture, and education since 2015. She also currently serves as the president of the Korea TESOL Yongin-Gyeonggi Chapter. Email: dtrinks@mju.ac.kr

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