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The Implementation of Flipped Learning Model in an ESP Context: An Investigation of Engineering Students' Attitudes and Expectations at the Biotechnology National School of Constantine

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Keywords

Biotechnology engineering; English for Specific Purposes (ESP); Flipped learning model; Students' attitudes; Students' expectations; Active learning strategies; Educational innovation

Abstract

In recent years, the flipped learning (FL) model has emerged as an innovative and increasingly popular approach to education, transforming how students engage with content and enhancing overall learning outcomes. This model reimagines traditional classroom dynamics by shifting from teacher-centered instruction to a more student-focused experience. In FL, students interact with instructional materials such as pre-recorded lectures, videos, or other multimedia resources outside class time. This frees up in-class hours for active, hands-on learning activities like discussions, problem-solving exercises, group projects, and practical applications that deepen understanding and foster collaboration. As such, the FL model holds promise in biotechnology education, where mastering theoretical concepts and hands-on skills is essential. By allowing students to acquire basic knowledge at their own pace before class, educators can dedicate face-to-face sessions to reinforcing and applying this knowledge in classroom activities. However, the success of FL often hinges on students' attitudes and expectations toward the model. Those who perceive it as a valuable tool for deeper learning are more likely to fully embrace it, while skepticism or resistance can hinder its effectiveness. This study explores the attitudes and expectations of second-year students at the Biotechnology National School of Constantine, Algeria, regarding the potential implementation of the FL model. Through a questionnaire administered to 47 students, the research seeks to understand how these learners perceive the benefits and challenges of adopting FL in their coursework. The findings offer critical insights not only for English for Specific Purposes (ESP) practitioners but also for administrators and educators considering the integration of FL into biotechnology classrooms and similar ESP contexts. By understanding students' perspectives, educators can design and deliver FL experiences that align with learners' needs and expectations, ultimately fostering their engagement, motivation, and academic success.

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Mots clés

Génie biotechnologique; Anglais pour des raisons spécifiques; Modèle d'apprentissage inversé; Attitudes des étudiants; Attentes des étudiants ; Stratégies d'apprentissage ; Innovation pédagogique

Résume

Ces dernières années, le modèle d'apprentissage inversé (FL) est apparu comme une approche éducative innovante et de plus en plus populaire, transformant la manière dont les étudiants interagissent avec le contenu et améliorant les résultats d'apprentissage globaux. Ce modèle réinvente la dynamique traditionnelle de la classe en passant d'un enseignement centré sur l'enseignant à une expérience davantage axée sur l'étudiant. Dans l'apprentissage inversé, les étudiants consultent des ressources pédagogiques (comme des cours préenregistrés, des vidéos ou d'autres supports multimédias) en dehors des heures de cours. Cela libère du temps en classe pour des activités d'apprentissage actives et pratiques, telles que des discussions, des exercices de résolution de problèmes, des travaux de groupe et des applications concrètes, qui approfondissent la compréhension et favorisent la collaboration.Ainsi, le modèle FL présente un potentiel prometteur dans l'enseignement de la biotechnologie, où la maîtrise de concepts théoriques et de compétences pratiques est essentielle. En permettant aux étudiants d'acquérir les connaissances de base à leur propre rythme avant le cours, les enseignants peuvent consacrer les séances en présentiel à renforcer et à appliquer ces connaissances dans des activités interactives. Cependant, le succès de l'apprentissage inversé dépend souvent des attitudes et des attentes des étudiants à son égard. Ceux qui le perçoivent comme un outil utile pour un apprentissage approfondi sont plus susceptibles de l'adopter pleinement, tandis que le scepticisme ou la résistance peuvent en limiter l'efficacité.Cette étude explore les attitudes et les attentes des étudiants de deuxième année de l'École Nationale de Biotechnologie de Constantine (Algérie) concernant la mise en œuvre potentielle du modèle FL. À travers un questionnaire administré à 47 étudiants, la recherche vise à comprendre comment ces apprenants perçoivent les avantages et les défis de l'adoption de l'apprentissage inversé dans leur cursus. Les résultats fournissent des insights essentiels, non seulement pour les enseignants d'anglais pour des raisons spécifiques (ESP), mais aussi pour les administrateurs et les éducateurs envisageant d'intégrer l'apprentissage inversé dans les cours de biotechnologie et d'autres contextes similaires en ESP.En comprenant les perspectives des étudiants, les enseignants peuvent concevoir et dispenser des expériences d'apprentissage inversé qui correspondent aux besoins et aux attentes des apprenants, favorisant ainsi leur engagement, leur motivation et leur réussite académique.

1. Introduction

In recent years, the Flipped Learning (FL) model has garnered significant attention as an innovative educational approach that redefines traditional teaching paradigms. Recognized as an effective pedagogical strategy for 21st-century learners, it leverages educational technology tools to enhance classroom learning outcomes (Varghese & Saravanakumar, 2022). By integrating digital resources with student-centered methodologies, the FL model fosters autonomy, critical thinking, and deeper

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engagement, making it a promising framework across disciplines—including language education.

English for Specific Purposes (ESP) represents a learner-centered approach to language instruction that addresses the specialized communicative needs of students within academic or professional contexts. Unlike English for General Purposes (EGP), which focuses on broad language acquisition for educational settings, ESP requires thorough needs analysis to tailor content to discipline-specific requirements (Bouguebs, 2019; Pardabaev et al., 2022). By prioritizing targeted linguistic competencies over general proficiency, ESP prepares learners to overcome real-world communication challenges in their fields. This pragmatic orientation explains its increasing adoption in higher education, where curricula must align with diverse career pathways (Hyland, 2022).

In biotechnology engineering education, students need to develop strong technical skills and effective professional communication. This necessitates integrating discipline-specific English directly with practical, relevant content. However, traditional English for Specific Purposes (ESP) instruction often falls short. It tends to be teacher-centered, which limits student engagement and opportunities for interactive learning (Sobirova & Karimova, 2021). Even more problematic, conventional ESP methods frequently treat professional content as mere "linguistic input" rather than valuable knowledge. This reduces authentic materials to tools for language acquisition, rather than sources for deeper, domain-specific learning (Liew & Ching Pey, 2015). As Britel (2022) highlights, the true authenticity of learning materials is determined by their relevance to the learning process and how well they reflect genuine professional scenarios.

The FL model addresses these gaps by enabling students to acquire foundational knowledge (e.g., terminology, core concepts) independently before class, thereby reserving in-person sessions for collaborative, application-based tasks. This shift not only strengthens language proficiency but also cultivates domain-specific competencies.

While the FL model offers compelling theoretical advantages for ESP instruction, its practical success depends critically on students' pre-implementation attitudes and expectations. These psychological factors directly shape learners' engagement levels, motivation, and ultimate learning outcomes. When students view FL positively, they will demonstrate greater commitment to pre-class preparation, be more active during the in-class participation, and exhibit stronger self-directed learning behaviors. Moreover, students' expectations regarding instructional delivery, accessibility of materials, and the perceived relevance of FL to their ESP needs can impact their readiness to adopt the approach. If students' expectations align with the reality of the flipped model, students are more likely to embrace the method. Therefore, assessing these factors beforehand allows educators to tailor the implementation process, address potential challenges, and optimize the learning experience for ESP students.

This study investigates 2nd-year biotechnology engineering students' attitudes and expectations toward FL before its implementation at the Biotechnology National School

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of Constantine. To reach the study objectives, the resaerchers departed from the following research questions:

- What attitudes do 2nd-year students hold regarding the potential implementation of the FL model?
- What expectations do they have about its structure and benefits?

This study hypothesizes that biotechnology engineering students will demonstrate favorable attitudes and expectations regarding the FL model's implementation, indicating their preparedness to adopt this innovative pedagogical approach.

By elucidating learners' perspectives, this research aims to inform tailored FL-ESP integration, ensuring alignment with student needs and maximizing engagement in biotechnology education.

2. Literature Review

2.1 Defining FL Model

To ensure effective teaching and precise assessment, it is essential to have a clear understanding of what defines the FL model. Many researchers in the field of education have provided various definitions of the concept of FL. The FL model shifts traditional in-class lectures to pre-recorded videos, tutorials, or simulations that students explore independently before attending class, postulates Rhode (2014). As a result, classroom time is dedicated to active engagement through problem-solving, discussions, practical applications of theoretical concepts, collaborative work, and innovative, interactive activities. Furthermore, the flipped approach seeks to turn class time into dynamic, interactive sessions or workshops where students can engage with the material, apply their knowledge in practice, and collaborate with peers through experiential learning activities (Sakulprasertsri, K. &Vibulphol, J., 2017).

From another scope, FL or inverted classroom is regarded as a form of blended learning that leverages technology to deliver lectures outside the classroom while using in-class time for hands-on activities and concept application (Strayer, 2012). Synthesizing these perspectives, FL emerges as an innovative pedagogical framework that fundamentally reorganizes learning spaces: direct instruction occurs primarily through curated digital resources outside class, while scheduled meetings become dedicated arenas for guided practice, interactive engagement, and meaningful application of acquired knowledge.

2.2 FL Model VS Traditional Teaching Model

Teaching methodologies have evolved significantly, with the FL model emerging as an alternative to the traditional classroom model. Unlike traditional classrooms, which

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are primarily teacher-centered, the flipped approach shifts its focus to facilitating student-centered learning.

To begin with, flipped classrooms seek to overcome the limitations of conventional classrooms. A key problem with traditional classes is that they spend most of the time on lectures, resulting in students being passive listeners and assigning them homework without direct access to assistance or guidance. In contrast, flipped classrooms adopt a different methodology. Students are provided with instructional videos before class, enabling them to engage actively during class sessions, request help, ask questions, and practice with the support of their teacher and classmates (Demirel, 2016).

The teacher's role varies significantly from the traditional classroom to the flipped classroom. While the instructor is present to instruct and guide the students in both formats, the focus transitions from the teacher being the main source of information to acting as a facilitator who assists students in grasping the concepts (Brown, 2016). In traditional lecture-based environments, the teacher is seen as the key authority, often described by King (1993) as the "sage on the stage," whereas in a flipped classroom, he or she takes on the role of "the guide by the side" (Baker, 2000). In this setting, the instructor helps facilitate in-class activities, providing essential assistance to students as they collaborate with one another to complete the tasks. This transition from a teacher-centered to a learner-centered model is depicted in the figure below.

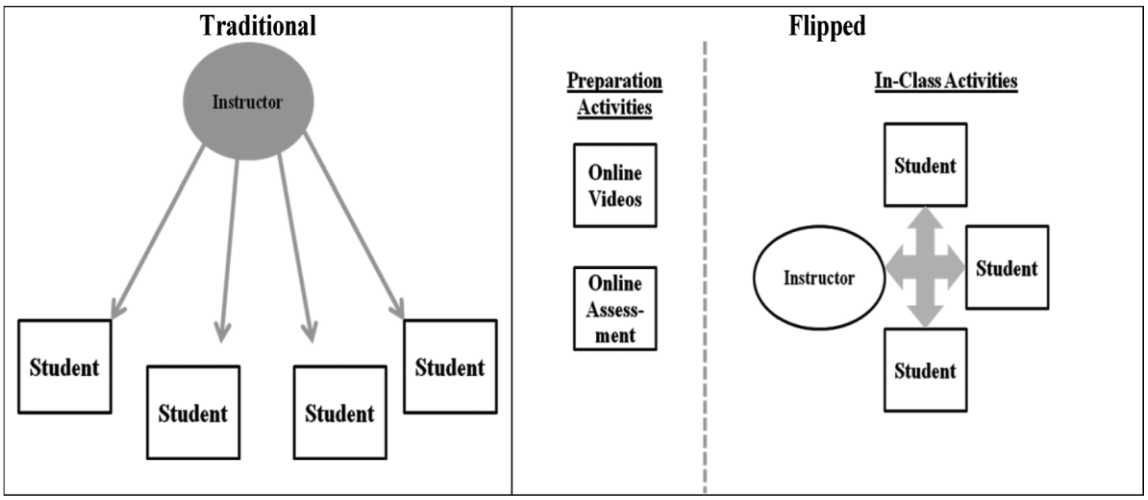


Figure1. The traditional vs. FL Classroom. *(source: Butler Velegol et al., 2015*)

2.2 Getting to the English for Specific Purposes (ESP)Field

2.2.1 Definition of ESP

Over the past three decades, ESP has evolved into a highly effective field. As a learner-focused approach, its primary goal is to meet the specific needs of students,

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equipping them with the language skills required for their professional or vocational pursuits. (Ramirez, C.G., 2015)

According to Mackay and Mountford (1978) “ESP is generally used to refer to the teaching of English for a clearly utilitarian purpose.” (p.2). That is to say, ESP refers to teaching English with a practical goal, focusing on the specific language skills needed for academic, professional, or occupational purposes. In addition, Hutchinson and Waters (1987) state, "ESP is an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning" (p.19). In other words, ESP is a language teaching approach where the content and methods are tailored to the specific reasons and needs of the learner, such as their academic or professional goals. Basturkmen (2006) also states: “In ESP, language is learned not for its own sake or for the sake of gaining a general education but to smooth the path to entry or greater linguistic efficiency in academic, professional or workplace environments” (P.18). Which means that in ESP, language is learned not for general knowledge or education but to enhance access and improve communication skills in academic, professional, or workplace settings.

ESP, then, focuses on teaching English for practical and professional use, aiming to develop specific language skills through real-life situations. As Hijuelos-Cruz et al. (2020) demonstrate, modern ESP implementation equips learners with precisely those linguistic skills, specialized vocabulary, and discourse patterns that are most relevant to their field of speciality or future profession.

2.2.2 The Difference between ESP and English for General Purposes (EGP)

In English language teaching, a fundamental distinction exists between ESP and EGP. While EGP aims to develop overall language proficiency for a wide range of everyday and academic contexts, ESP is tailored to meet the specific linguistic needs of learners in professional or academic disciplines such as medicine, engineering, or business. The distinction between ESP and EGP has been widely explored by numerous researchers in the field of language education. Understanding these differences is essential for designing effective language instruction that aligns with learners’ goals and expectations.

In their book: “English for Specific Purposes. A learning-centered Approach”, Hutchinson and Waters (1987) answer the question: what is the difference between ESP and EGP? “in theory nothing, in practice a great deal” (p.53). This statement highlights the idea that while both ESP and EGP share the same fundamental principles, their practical applications differ significantly. Hutchinson and Waters explain this by claiming: “What distinguishes ESP from General English is not the existence of a need…but rather an awareness of the need” (p.53). In other words, it is always possible to specify what students need in both ESP and General English (GE). However, it is the awareness of why students need to learn English that makes the difference between ESP and EGP as this awareness influences what content is to be presented to the students.

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The two main differences between ESP and EGP, as stated by Rahman (2015) include the nature of students and the aim of instruction. According to this scholar, unlike EGP learners, ESP learners are typically adults with some prior knowledge of English who study the language to develop professional skills and carry out job-related tasks. The aim of instruction also differs. For example, in GE instruction, equal emphasis is placed on all four language skills: listening, reading, speaking, and writing. In contrast, ESP relies on a needs analysis to identify the most essential skills for learners, shaping the syllabus to meet those specific requirements (Rahman, 2015 as cited in Flowerdew, n.d.).

From another scope, Basturkmen (2006) contrasts the open-ended nature of GE with the goal-oriented approach of ESP. GE focuses on broad language acquisition without a clearly defined endpoint, allowing learners to explore various aspects of the language. In contrast, ESP is structured around a specific goal; ensuring learners acquire the precise language skills needed for their professional or academic field. This targeted approach makes ESP more efficient and purpose-driven, guiding learners swiftly toward their intended destination.

As for ESP teachers' pedagogical roles, Kamolovna (2022) states that ESP teachers have some additional responsibilities compared to EGP teachers. While both share common teaching roles, ESP practitioners must also act as materials designers, facilitators, consultants, and researchers. Their flexibility is crucial due to evolving learning situations and student autonomy. Given these challenges, ESP teachers require specialized training in needs analysis and materials development to effectively meet their students' specific needs and expectations.

In brief, while both ESP and EGP share the goal of enhancing language proficiency, they differ significantly in their focus, approach, and application. ESP is tailored to meet the specific needs of learners in particular professional or academic fields, emphasizing targeted language skills based on a thorough needs analysis. In contrast, EGP provides a broader foundation in language, developing general communication skills that can be applied across various contexts. Understanding these differences is crucial for designing effective language instruction that aligns with the unique goals and motivation of learners.

2.2.3 ESP for Biotechnology

Biotechnology is a multidisciplinary field that integrates biology, chemistry, engineering, and technology to develop innovative solutions in medicine, agriculture, and environmental science.

In biotechnology engineering, ESP plays a crucial role in equipping students with the language skills necessary to engage with scientific literature, conduct research, and communicate effectively in academic and industry settings. As English is the dominant language for scientific publications, conferences, and international collaboration, biotechnology engineering students must acquire proficiency in technical vocabulary,

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research writing, and oral communication. ESP courses for biotechnology focus on developing these skills through tailored materials, such as scientific articles, lab reports, research presentations, and technical documentation**.**

With expanding job opportunities in Biotechnology, students need multiple skills, including effective communication, creative and critical thinking, teamwork, and strong interpersonal and soft skills. However, many technically proficient students struggle in job interviews due to poor communication skills, and some top-ranking graduates miss opportunities for higher studies abroad due to low TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Testing System) scores. Even employed engineers have been dismissed for inadequate English skills. Therefore, Educationists and employers stress the urgent need to improve students' communication abilities. This has led to the need for ESP courses tailored to fields like Biotechnology, highlighting the importance of a specialized language syllabus (Chauhan, 2015).

Biotechnology distinguishes itself from humanities disciplines (e.g., history, literature) and other engineering fields through its primary focus on manipulating living systems and organisms to create innovative products and processes, particularly in food production and processing. The specialized language of biotechnology engineering directly mirrors its unique phenomena, methodologies, and technological processes. Teaching ESP in this field presents distinct challenges due to its inherently interdisciplinary character. Students must not only comprehend complex scientific concepts but also apply this understanding to develop practical solutions for food-related challenges. Consequently, ESP instructors must strategically design curricula and develop instructional materials that systematically incorporate technical terminology from multiple contributing disciplines—including botany, chemistry, zoology, agriculture, and food technology—to effectively support biotechnology students' academic and professional language needs. (Bojović, 2022)

3. Methodology

3.1 Context

The present study was conducted at the National School of Biotechnology, Constantine, Algeria; locally known as Ecole Nationale Supérieure de Biotechnologie Taoufik Khaznadar (ENSB). Founded in 2011, the institution is a pioneering initiative in Algeria that strategically enhances the higher education programs of leading engineering schools by incorporating specialized technological training in the diverse and dynamic applications of life sciences.

3.2 Participants

The study population comprised all second-year biotechnology students at ENSB, with 47 students (42 female, 5 male) voluntarily completing the anonymous online questionnaire administered via Google Forms.

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3.3Research Design

This study employed a descriptive research design using an online questionnaire to assess second-year biotechnology students' attitudes and expectations regarding FL model prior to its implementation.

3.4 Procedures

On November 19, 2024, the questionnaire was submitted online on the Moodle platform of ENSB. Surprisingly, no answers were received from the students. By the end of January 2025, the researcher sought the help of the head of the department who kindly offered assistance and shared the questionnaire online with second-year students. 47 responses were finally collected. The researcher then reported and analyzed the data to draw a valid and credible conclusion for the research. The questionnaire includes two sections (see appendix). The first section aims to gather some background information including 2 questions about students' gender and age; while the second section gathers information about students' attitudes and expectations toward the FL model implementation. This section consists of 7 questions ranging between closed-ended and open-ended questions.

4. Results

4.1 Familiarity with the FL Model Concept

Before asking the participants whether they already know the concept of FL, the researcher provided a brief definition of the FL model. The answers to this question are illustrated in the figure below:

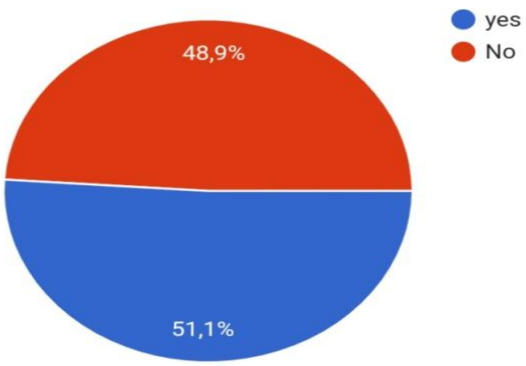


Figure1. Students' Familiarity with the Concept of the FL Model

The responses to this question indicate that students had mixed levels of familiarity with the FL model prior to the study. While 51.1% of participants reported

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being aware of the concept, 48.9% stated that they had not encountered it before. Following this, participants were asked to express their attitudes toward FL model implementation.

4.2 Attitudes towards the FL Model Implementation

Assessing students' attitude towards FL model implementation would help the researchers to gain insights into their receptiveness to adopting this instructional approach. Participants' responses are gathered in the following table.

Table 1.

Students' Attitudes towards the FL Model Implementation

Items	Percentages (%)
Very excited	17 %
Excited	59.6%
Neutral	23.4%
Anxious	0 %
Very anxious	0%

The results presented in Table 1 indicate an overall positive attitude toward the FL model implementation. Most students (59.6%) reported feeling excited about the approach, while an additional 17% expressed being very excited. Combined, these responses represent 76.6% of participants expressing positive attitudes toward FL model. Conversely, 23.4% of respondents remained neutral, suggesting ambivalence or a wait-and-see stance toward the adoption of this instructional model.

4.3 Students' Learning Preferences

To understand students' learning behaviors, participants were asked to express their preferred mode of learning, whether digital, traditional, or a combination of both.

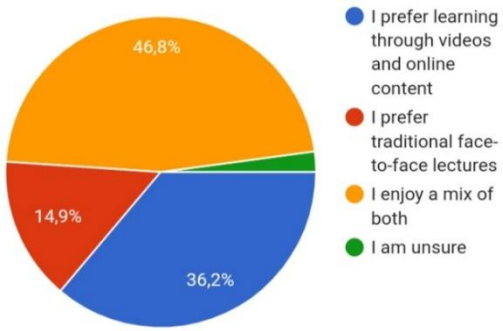


Figure 2. Learning Preferences: Digital vs. Traditional Approaches

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The results presented in Figure 2 reveal that the majority of students hold a positive attitude toward the integration of digital learning methods into their educational experience. Notably, 46.8% of respondents indicated a preference for a blended approach combining videos/online content with traditional face-to-face lectures. Furthermore, 36.2% expressed a preference for engaging with videos and online materials prior to class sessions. In contrast, only 14.9% favored exclusively traditional face-to-face instruction, while a marginal 2.1% remained undecided.

4.4 Preferred In-Class Activities in FL Model Classroom

In addition to the preferred mode of instruction, participants were asked to specify the classroom activities they find most engaging and beneficial.

Table 2.

Preferred In-Class Activities

Items	Percentages (%)
Group discussions	46.8%
Problem-solving tasks	55.3%
Case studies related to biotechnology	48.9%
Role playing or simulation exercises	17%
Collaborative projects with peers	10.6%
Individual or group presentations	27.7%

Table 2 summarizes students' perspectives on the types of in-class activities they believe should follow engagement with pre-class learning materials. The results reveal diverse preferences, with a pronounced inclination toward interactive and application-based pedagogical approaches. Problem-solving tasks were the most strongly favored, selected by 55.3% of participants. Similarly, case studies in biotechnology (48.9%) and group discussions (46.8%) were also highly preferred, underscoring students' preference for collaborative and applied learning modalities.

Other activities received less support but still indicate varying interests. Individual or group presentations (27.7%) were moderately favored. Meanwhile, role-playing or simulation exercises (17%) and collaborative projects with peers (10.6%) were less popular.

4.5 Perceived Pedagogical Benefits of FL Model

After identifying students' preferences for in-class activities, the study further explored their perceptions of the potential benefits associated with the FL model. Findings are summarized in the table below.

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Table 3.

Students' Perceptions of FL Model Benefits

Items	Percentages (%)
Increased student engagement	38,3%
More flexible learning (e.g., learning at your own pace)	53,2%
Opportunity for deeper understanding through self-study	42,6%
More time for discussions and interactive activities in class	34%
More effective use of class time	23,4%
Greater interaction with peers and teacher	21,3%
Other answers: Boost self-confidence	2,1%

According to Table 3, students' anticipated benefits of the FL model in their English course are distributed across several key areas. Flexible learning emerged as the most prominent advantage, cited by 53.2% of respondents. A substantial proportion (42.6%) indicated that the model enhances conceptual understanding through self-directed study, while 38.3% linked it to improved engagement. Additionally, 34% expected the FL model to allocate more class time for interactive discussions. Less frequently identified benefits included efficient class time utilization (23.4%) and strengthened peer/instructor interaction (21.3%). Strikingly, only one participant (2.1%) associated the approach with self-confidence development.

4.6 Anticipated Challenges and Concerns of FL Model

While students recognized several benefits of the FL model, they were also invited to report any anticipated difficulties regarding the adoption of this innovative approach. Participants' responses are included in the following table.

Table 4.

Anticipated Challenges and Concerns

Items	Percentages %
Difficulty with self-directed learning (learning alone out of class)	34%
Difficulty in understanding pre-class materials (e.g., videos, readings)	19,1%
Lack of motivation to engage with-out-of class learning materials	29,8%
Prefer traditional teaching methods	14,9%
Lack of access to necessary technology (e.g., internet, devices)	31,9%
Technical issues related to internet connection	36,2%

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According to the results displayed in Table 4, students anticipate facing both technological and self-regulated learning challenges with FL model implementation. The data reveal that technical issues constitute the most significant barrier, with internet connectivity problems (36.2%) and lack of technological access (31.9%) emerging as primary concerns. Regarding learning process challenges, 34% of respondents reported difficulties with autonomous learning, while 29.8% cited motivation deficits for pre-class preparation. Notably, only 19.1% expressed concerns about understanding pre-class materials, and a mere 14.9% indicated a preference for traditional teaching methods over the flipped approach.

4.7 Teacher's Role in FL Model

In addition to examining pedagogical benefits and concerns, the study explored how students perceive the teacher's evolving role in a flipped classroom environment.

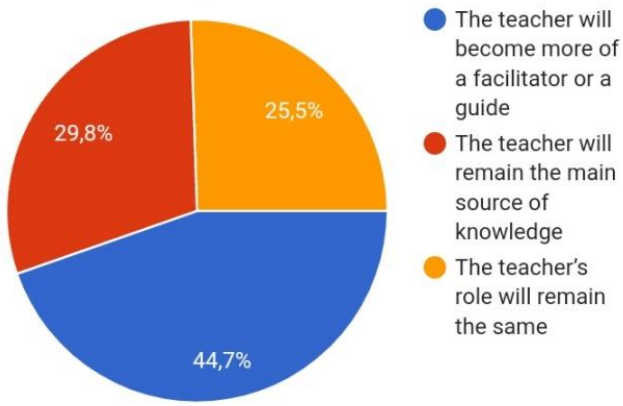


Figure 3. Perceptions of the Teacher's Role

Figure 3 demonstrates participants' divergent expectations regarding the teacher's role in a flipped learning environment. 44.7% of the participants anticipate a shift toward a more facilitative instructional approach, where teachers act as guides rather than primary knowledge providers. However, 29.8% expect teachers to maintain their traditional role as central knowledge authorities, while 25.5% foresee no significant change in teaching responsibilities.

5. Discussion

This study examined the attitudes and expectations of second-year biotechnology engineering students toward the FL model before its implementation. The research findings align with the research hypothesis that students maintain positive attitudes

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toward this pedagogical approach, consistent with previous studies documenting student receptiveness to innovative learning methods (Bergmann & Sams, 2012; Bishop & Verleger, 2013). The results offer practical insights for implementing FL in ESP contexts while providing recommendations for effective adaptation in similar academic settings.

A noteworthy finding concerns students' demonstrated enthusiasm for the FL model, with 51.2% expressing excitement or strong interest despite 48.9% reporting no prior experience with this pedagogical approach. This finding suggests that biotechnology engineering students, similar to STEM (Science, Technology, Engineering &Mathematics) learners in Hung's (2015) study, exhibit readiness to adopt innovative teaching methods when their educational value is apparent. The positive reception aligns with Chen et al.'s (2018) contention that perceived usefulness significantly predicts technology acceptance in educational settings. Such findings should encourage educators to implement research-based pedagogical innovations without overestimating potential student resistance, though appropriate scaffolding remains essential (Vygotsky, 1978).

While the FL model relocates substantial learning time outside the classroom, participants favored a balanced approach over complete replacement of traditional instruction. Although many supported digital pre-class materials, most of them preferred a hybrid model blending lectures with flipped elements. This echoes findings by Akçayır and Akçayır (2018), who noted that blended approaches often yield higher satisfaction than fully flipped designs, as they accommodate diverse learning preferences. The observed preference may stem from the hybrid model's capacity to accommodate diverse cognitive styles (Bouguebs, 2019b) while maintaining the structural benefits of face-to-face guidance. Educators should therefore consider flexible implementation strategies rather than rigid adherence to a fully flipped paradigm.

Regarding in-class activities, students showed a strong preference for applied tasks like problem-solving (55.3%), discipline-specific case studies (48.9%), and collaborative discussions (46.8%). However, the varied preferences for other activities (e.g., role-playing, presentations) underscore the need for differentiated task design, as recommended by Tomlinson (2016) in his principles of inclusive instruction. This aligns with the idea that a careful needs analysis should be undertaken before the design of any ESP course to ensure that all students remain engaged and see the relevance of their coursework.

As far as the benefits of the FL approach are concerned, multiple FL benefits were identified including flexibility (53.2%), deeper self-directed learning (42.6%), and enhanced interaction (38.3%). These perceptions reflect FL advantages documented in Lo and Hew' study (2017), suggesting learners intuitively understand the model's pedagogical value. However, identified challenges (technological barriers related to internet issues (36.2%) and device access (31.9%); and self-regulation difficulties (34%) align with what was highlighted by O'Flaherty and Phillips (2015) regarding FL model

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implementation barriers. Institutional support for infrastructure and study skills development appears crucial for successful adoption.

The study reveals two fundamental dimensions influencing FL model success: student readiness and institutional support. While many students (44.7%) welcomed the active learning approach where the teacher's role is a guide and a facilitator, a significant group (29.8%) remained attached to traditional teacher-centered expectations, highlighting the challenge of changing established learning cultures. The implementation barriers were equally important, with 34% of students struggling with self-directed learning and 31.9% facing technological limitations. These findings suggest that successful flipping requires more than just rearranging classroom activities—it demands careful preparation of both learners (through gradual autonomy development) and learning environments (through reliable infrastructure and clear pedagogical communication). The most effective implementations will likely balance innovation with accommodation, introducing flipped elements progressively while addressing both technical and psychological transition needs.

6. Conclusion

The results of this study indicate that biotechnology engineering students generally have positive attitudes and expectations toward the FL model. They recognize many benefits of the model and anticipate some challenges related to technical accessibility, self-directed learning, and motivation. This calls for ESP practitioners and material designers to provide structured support, well-designed content and to ensure a good working environment. These requirements are the key to ensuring an effective adoption of the flipped model. Also, by aligning classroom activities with student preferences and interests, the FL model can enhance both engagement and academic performance in ESP education. Last but not least, it is very important to consider students' attitudes and expectations before adopting the FL model because its success could be influenced by students' preliminary views of it.

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Appendix (1): Students' Questionnaire

This questionnaire is part of a research study that aims to gather your thoughts, attitudes, and expectations regarding the potential introduction of the Flipped Learning (FL) model in your English course. Please answer all questions honestly. Check the box that best reflects your response and provide a complete answer where indicated. Your responses will help guide the successful implementation of the FL model in the future. The questionnaire is anonymous, and your participation is voluntary.

Section 1:Background Information

1. Gender

- ☐ Male
- ☐ Female

2. Age: ……

Section 2:Expectations and Attitudes toward the FL Model Implementation

Definition: The FL model is an instructional strategy where the lesson is taught outside the classroom (often through videos or other online resources) while classroom time is devoted for interactive activities such as group discussions, problem-solving, projects, hands-on applications…etc.

3. Before this questionnaire, were you familiar with the concept of the FL Model?

- ☐ Yes
- ☐ No

4. How do you feel about the idea of using the FL Model in your English class?

- ☐ Very Excited
- ☐ Excited
- ☐ Neutral
- ☐ Anxious
- ☐ Very Anxious

5. Do you prefer learning through videos and online content before coming to class, or do you prefer traditional face-to-face lectures?

- ☐ I prefer learning through videos and online content
- ☐ I prefer traditional face-to-face lectures
- ☐ I enjoy a mix of both
- ☐ I am unsure

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6. What type of activities do you think should take place in the classroom after engaging with learning materials outside of class?

(Check all that apply)

- ☐ Group discussions
- ☐ Problem-solving tasks
- ☐ Case studies related to Biotechnology
- ☐ Role-playing or simulation exercises
- ☐ Collaborative projects with peers
- ☐ Individual or group presentations
- ☐ Other (please specify):

……

7. What do you think are the potential benefits of using the FL model in your English course?

(Check all that apply)

- ☐ Increased student engagement
- ☐ More flexible learning (e.g., learning at your own pace)
- ☐ Opportunity for deeper understanding through self-study
- ☐ More time for discussions and interactive activities in class
- ☐ More effective use of class time
- ☐ Greater interaction with peers and instructors
- ☐ Other (please specify): ……

8. What challenges or concerns do you anticipate encountering with the implementation of the FL model in your classes?

(Check all that apply)

- ☐ Difficulty with self-directed learning (learning alone out of class)
- ☐ Difficulty in understanding pre-class materials (e.g., videos, readings)
- ☐ Lack of motivation to engage with out-of-class learning materials
- ☐ Prefer traditional teaching methods
- ☐ Lack of access to necessary technology (e.g., internet, devices)
- ☐ Technical issues related to internet connection
- ☐ Other (please specify):

……

9. How do you think the teacher's role will change in a flipped classroom environment?

- ☐ The teacher will become more of a facilitator or a guide
- ☐ The teacher will remain the main source of knowledge

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- ☐ The teacher's role will remain the same
- ☐ Other (please specify): ……

Thank you for taking the time to complete this questionnaire. Your responses are invaluable for helping shape the future of your English language education in Biotechnology. We appreciate your input!

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Authors' Contribution
Both authors contributed to the conception and design of the study. Material preparation, data collection, and analysis were carried out by Lamia Benyahia. Dr. Radia Bouguebs was responsible for proofreading and refining the manuscript. Both authors reviewed and approved the final version of the manuscript.

Declaration of conflicting interest
The authors declared no conflicts of interest with respect to the research, authorship, and/or publication of the article.

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