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**| RESEARCH ARTICLE**

## **Assessing the Efficacy and Acceptance of Flipped Classroom Method in Tertiary-Level English Vocabulary Learning: A Thematic Data Analysis in Post-Pandemic Bangladesh**

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**| ABSTRACT**

Advances in technology have caused a significant impact across sectors, including education, which has resulted in the enhancement of systems worldwide, especially in developing countries like Bangladesh. This study probes into the application and adequacy of employing the flipped classroom method in English as a second language (ESL) learning at the tertiary level in Bangladesh as a new initiative that arises from the proliferation of technology. English as a second language instruction in Bangladesh has been teacher-fronted, which limits student participation and language acquisition. However, with the movement to online teaching brought about by the pandemic, it is clear that language instruction must meet the needs and expectations of students. The vital role of vocabulary acquisition for communication and understanding of cultural differences in particular settings makes vocabulary learning critical, and innovation is essential for increased vocabulary acquisition, recall, and retention. The flipped classroom model allows the students to engage with the content before they come to class, allowing classroom time to be more highly interactive and allowing for a variety of pedagogies and learning environments. To investigate the potential of employing the flipped classroom to redress the challenges of traditional vocabulary pedagogy in ESL settings given limited English exposure outside of class, the research assesses the proficiency of students in Bangladesh in applying the flipped learning model and whether using the model ensures language learning and vocabulary acquisition. Using survey data and thematic data analysis from a group of students at the tertiary level, the research examines the effectiveness of the method, the general acceptance, and the challenges of implementing the method in the classroom to give recommendations and guidance to improve the quality and effectiveness of the flipped classroom in practice for language learning and vocabulary acquisition.

**| KEYWORDS**

Flipped Classroom, Vocabulary Acquisition, ESL Learning, Tertiary Education, Blended Learning, Covid-19.

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### **1. Introduction**

The progression of technology has made the world dynamic by associating vital parts of life, such as science, education, and medicine. This has the potential to greatly improve education worldwide, even in developing countries, such as Bangladesh. Of all the advancements in technology, the flipped classroom, an offspring of technological advancements, is an important educational practice. The role of technology in education is especially significant in Bangladesh. Blended learning and flipped classrooms are still relatively unheard of in the context of language learning in Bangladesh. English language teaching (ELT) provided at the secondary level is traditionally teacher-centered, meaning student engagement and achievement is often minimal due to lack of critical interaction. Interaction plays a major part in language learning, particularly in second languages, and is shown to be critical to successful language learning. The situation in tertiary institutions in Bangladesh has changed somewhat with the pandemic, and

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learners are more comfortable with online learning than in the past. Student interaction is more likely to change at the tertiary level, with opinions about the effectiveness of traditional methods of teaching being changed. This change highlights the need for good teaching practices to encourage student success in terms of learning outcomes and engagement. In language learning, particularly EFL, vocabulary becomes even more important. Studies support the idea that, without a broad vocabulary bank, effective communication cannot be established yet others contend that vocabulary is, therefore particularly important for EFL students to acquire. Vocabulary is significant to language acquisition and cultural understanding. Words in a language may be complicated, but their importance and potential for words to represent culture cannot be understated. Vocabulary is an essential element of acquiring a language (Bush, 2007), and lexis (the study of words) is the most challenging aspect of learning a language. Other researchers argue that vocabulary is significant for successful language acquisition and language success. Technology as a catalyst for teaching and learning has created a better teaching and learning environment. This means that educators are encouraged to use technology in their teaching and take the opportunity to take advantage of the recent advancements in technology. Established teaching approaches are being questioned and the flipped classroom is a replacement for traditional approaches of teaching (Piyatamrong, Derrick, & Nyamapfene, 2021). In a flipped classroom, students are introduced to new content using video lessons outside of the classroom, and they are then responsible for reviewing the content before class commences. Class time is then used for interactive discussions and assignments, making for a more dynamic, flexible learning environment (Wu, Hsieh, & Yang, 2017). This process can be particularly beneficial for vocabulary learning in EFL contexts, where opportunities for vocabulary acquisition outside the classroom are limited (Noroozi, Rezvani, & Ameri-Golestan, 2020). The use of the flipped classroom model allows students to prepare for classes outside of class hours and focus on skills such as vocabulary during class time (Fulton, 2012). Learners, such as ESL/EFL students, are mostly exposed to English in circumstances where it is not as widely spoken language through their classes and by memorization of word lists. Students need to engage with innovative, cutting-edge teaching tactics that motivate them in order to improve vocabulary learning, application, and retention. In order to evaluate the efficacy of the flipped classroom paradigm in second language instruction at the collegiate level in Bangladesh, this study attempts to identify implementation challenges. The flipped classroom idea may have benefits, but nothing is known about how well it works or how to implement it in Bangladesh's higher education system. Further research is needed to determine whether the flipped classroom paradigm might impact students' engagement and vocabulary acquisition, as well as their overall performance in learning English as a second language. More precisely, to what extent does Bangladesh's higher education system benefit from the flipped classroom concept? To find out if the flipped classroom paradigm can affect students' success in learning English as a second language overall, as well as their engagement and vocabulary acquisition, more research is required. More specifically, how useful is the flipped classroom concept in Bangladesh's higher education system? Will the majority of students be well-positioned for success in their English as a second language (ESL) and in acquiring vocabulary in tertiary contexts if the exact implementation of the flipped classroom model is implemented? This study examines how well flipped classrooms work in Bangladeshi higher education for second language acquisition. The purpose of this study is to look into how flipped classroom strategies are adopted and how they affect teachers and students in higher education. It also examines the challenges that come with putting flipped classrooms into practice in a language-learning setting where teaching vocabulary in a second language is crucial.

## **2. Literature Review**

### **2.1 Origin of Flipped Classroom**

The "flipped classroom" was first proposed by Maureen Lage, Glenn Platt, and Michael Treglia in 2000. Essentially, they said the traditional classroom content would be delivered at home (Lage, Platt, & Treglia, 2000) and the traditional homework would then be done at school. The flipped classroom is a pedagogical model in which traditional content delivery and instruction are done online, and in-person class activities are delivered at home. It is meant to improve student learning because it increases the "impact" of the student learning and because it can lead to "immediacy" (Bryan Goodwin & Kirsten Miller, 2013). Blended learning, which is the combination of online and traditional or offline learning, has changed the foundation of the education field forever. One of the best uses of blended learning is to increase the quality and efficiency of teaching and learning in education, specifically in the form of the flipped classroom. For example, chemistry teachers Jonathan Bergmann and Aaron Sams were the pioneers in the flipped classroom at Woodland Park High School (U.S.) when they recorded and uploaded lectures and notes online for students who missed class. Each student and teacher had an increased opportunity to learn more effectively. The COVID-19 pandemic increased the use of the flipped classroom because the pandemic increased the necessity to find more effective ways to language education. One promising instructional method for second language acquisition, especially in English as a Foreign Language contexts, is the flipped classroom because vocabulary acquisition happens during class time.

### **2.2 Principles of Flipped Classroom**

The flipped classroom model refers to moving the content typically taught in the classroom to the home, as well as requiring students to watch the lecture. The concept flips the use of in-class time to move away from and reduce, lectures to incorporate individual and/or group exercises to deepen learning and the application of content, which emphasizes vocabulary teaching regarding three main goals (Nation, 2000): vocabulary size, which is the vocabulary of a native speaker, and strategic vocabulary

for efficient communication in the target language. Effective communication is not an option without vocabulary control (Namaziandost, Rezvani, & Polemiku, 2020). Effective communication, learning vocabulary, and retaining vocabulary are possibly the most essential aspects of acquiring language, and we need some creativity to deliver content in an engaging manner that allows learners to interact with others in activities similar to classroom instruction (Meuwese, 2002; Bush, 2007). The flipped classroom model of language teaching is believed to be a great pedagogical vehicle to expose students to vocabulary through various means of content delivery, such as reading, textual materials, discussion, or video delivered in one form from a lecture, a workshop, or a piece of study materials (Abeysekera, & Dawson, 2015). This model has the potential to greatly enhance vocabulary acquisition, as well as more interaction and more personalization in daily class activities. The model of the flipped classroom of language learning has indicated an increase in student engagement and language development, mostly by providing additional time for expressive practice or adaptive practice in a more contextualized modality (Cheng, Hwang, & Lai, 2020). In Bangladesh, when the novel COVID-19 virus emerged, online and blended language platforms, especially in higher learning, became a more vital avenue to consider. Currently, a great deal of attention is focused on the model of the flipped classroom as a pathway to promote skills in an additional language. Many universities in Bangladesh have highly adapted to various innovative means to improve learning and to keep pace with the world in which they now reside. Accordingly, the flipped classroom model is especially effective for vocabulary acquisition because flipping the classroom model allows students to step through the information before class, and then have language-based activities and interactions during class. The flipped classroom model as a pedagogy for English language teaching is a pedagogy that is recognized as a pedagogy that should facilitate vocabulary acquisition for EFL students in Bangladesh, leading to English proficiency which is essential for global communication and development. This pedagogy signals a departure from a teacher-directed pedagogy to learning-centredness and understanding of teaching and learning more engaging and dynamic. The flipped classroom model is also innovative and an effective learning model for vocabulary learning, which can augment and ameliorate the learning of new vocabulary. The advantages of educational innovations can be measured by productivity, time efficiency, and cost efficiency (Chowdhury, 2020). Vocabulary acquisition is one of the basics of language acquisition (Ramos & Restrepo, 2015). Vocabulary is crucial for language learners because vocabulary is a tool to help with communication. Scholars have argued that vocabulary is essential for English acquisition for language learners and understanding the culture of the language (Bush, 2007). Vocabulary learning in the flipped classroom allows for the student to be more engaged with the material by presenting the material in a variety of different ways to the student. This also allows for more recall and retention of the material (Meara, 1980; Xu & Hsu, 2017).

### **2.3 Use of Flipped Classrooms Around the World**

The Flipped model of learning has been used in many parts of the world. The researchers who have examined the use of the flipped model of learning to improve vocabulary have been done in different countries. For example, Knezevic (2020) has found the use of a flipped model of learning to significantly improve academic vocabulary in English for Academic Purposes courses. Izadpanah (2021) has shown that flipped activities have positively affected vocabulary retention for Iranian EFL learners. Similarly, Fahandezh (2021) highlighted that a gamified flipped classroom positively improves the vocabulary of pre-intermediate Iranian EFL learners. Other researchers like Kırmızı & Kömeç (2019), and Alnuhay (2018) reported the same results in their studies regarding the flipped method of learning and improvement in vocabulary. This indicates that flipped classrooms offer a more engaging and effective learning environment compared to traditional methods.

### **2.4 Findings from Research**

Data from various studies conducted on the model has revealed that the flipped classroom model is an effective strategy when it comes to improving the students' vocabularies. All works proved that the use of the flipped classroom approach has superior results to the normal classroom approaches namely; a superior classroom performance particularly in terms of vocabulary mastery, recall, and retention. These bits of information can be utilized by language teachers, policymakers, and curriculum planners to understand the potential positive impacts flipped classrooms have in enhancing vocabulary acquisition. The flipped model is a helpful concept when it comes to imparting languages to learners that could foster higher student engagement and enhanced results. The implementation of such a system has introduced several opportunities in Bangladesh for teaching methodologies that can revolutionize the concept of learning a second language. Introducing this model of teaching for English language learners, provides an opportunity for students to learn English and overcome some of the realities that have been experienced in the traditional approaches to language learning.

### **2.5 Efficacy of the Strategy in Bangladesh**

The concept of the flipped classroom has already been implemented as a new mode of teaching system in Bangladesh; which has been applicable when the COVID-19 situation forces facilities schools and colleges to close their door to online classes. Both the teachers and the students have used this new approach to teach and learn and have agreed that it is advantageous in learning vocabulary and the general mastery of language. A flipped classroom approach not only made a positive impact on the class setting by improving students' vocabulary and language proficiency learning experiences but also helped prepare them for in-class activities and offered them more time for self-learning, according to an instructor at a university in Bangladesh. Furthermore,

the implementation of a flipped classroom impacts the students in the high-stakes exams TOEFL, IELTS, and GRE because Vocabulary matters. According to the results regarding Bangladesh's students, it was found that the flipped classroom strategy is beneficial, and students are experiencing better vocabulary enhancement and language skills.

### 2.6 Literature Gap

Nevertheless, the current study supports the effectiveness of the approach known as the flipped classroom method; in the meantime, knowledge regarding the execution of research in settings like Bangladesh is scarce. Bangladesh is one of those countries that never prioritized the implementation of technology in the teaching system to a great extent like some other countries. Providers and takers of knowledge equally struggle to adapt to developmental teaching methods. This research proposal is aiming at exploring the flipped classroom approach for vocabulary in the context of Bangladesh based on the literature survey on the concept of flipped classrooms, the advantages, and the limitations of this method. Therefore, the findings of this study will give meaningful insight into the flipped classroom strategy for the teaching of vocabulary in the Bangladeshi context. In the case of the investigation, the information can be used to improve/shape the current and future practice of the teachers involved and the developmental and pragmatic actualization of the flipped classroom approach to language education in such a Bangladeshi context as this.

### 3. Methodology

This study employs the qualitative research methodology. To critically defend the use of flipped language as one of the most innovative and practical methods for second language acquisition worldwide, particularly in Bangladesh, several research studies have been examined. The purpose of qualitative research methodologies is to better understand how a target audience behaves and perceives a certain issue. Numerous qualitative research methodologies are employed, including content analysis, focus groups, ethnographic research, in-depth interviews, and case studies. (Bhat, 2023)

The survey is a research tool in this study. The information gathered and used in this research came from a survey given to a group of university students. A series of questionnaires is required to carry out the study. A set of questions designed to gather valuable data from participants is called a questionnaire, which is a research instrument. These tools have an interview-style format and contain both written and spoken questions. It is not always necessary to administer questionnaires with a researcher present; they can be completed online, over the phone, on paper, or in person. Questionnaires can be qualitative or quantitative. (*Types of Research Questionnaires | What Is a Questionnaire, 2022*). The questionnaire focused on the various facets of the flipped classroom approach for teaching vocabulary and second languages. Since this study makes use of already published research, ethical approval was not needed. The information is gathered from university students. This procedure is lawful and voluntary. The pupils consent to taking part in the survey. Nonetheless, the study complies with ethical guidelines, including protecting research participants' privacy and confidentiality and citing the sources of the chosen studies.

The target audience for this study is tertiary students. A group of people who have been familiar with the method since Higher Secondary College has been selected by the researcher. Online classes were held to carry on the education process during lockdown. These pupils are currently accepted into a university's English department. The target audience for this study is tertiary students. A group of people who have been familiar with the method since upper secondary school has been selected by the researcher. Online classes were held to carry on the education process during lockdown. These pupils are currently accepted into a university's English department.

### 3.1 Materials

#### 3.1.1 Questionnaires

The author made a bunch of surveys to learn from people about their thoughts on using the flipped classroom way to teach words and other languages.

##### 1. Qualitative Questions:

- These questions allow people to give more details about their thoughts and feelings regarding the flipped classroom method.
  - **Example:**
    - "Can you share how you felt about using the flipped classroom way for learning vocabulary?"
    - "What did you think was the best part of the flipped classroom for learning a new language?"

##### 2. Quantitative Questions:

- The author used a scale to see how much people agree or feel about different parts of the flipped classroom method.
  - Example statements (participants respond on a scale from 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree):
    - "Using videos and worksheets at home made it easier for me to learn new words."

- "I think studying this way before class helped me remember words better."

**Table 1:** Participant Responses to Questionnaires on Flipped Classroom Approach for Teaching Vocabulary and Second Languages

Participant	Qualitative Responses	Quantitative Responses (Likert Scale: 1-5)
Participant 1	"I found the flipped classroom approach very engaging and interactive. It helped me understand vocabulary in context better than traditional methods."	"4 (Agree)"
Participant 2	"The pre-recorded lectures allowed me to review material at my own pace, which was beneficial for learning new vocabulary words."	"5 (Strongly Agree)"
Participant 3	"I appreciated the opportunity to discuss vocabulary topics with peers during in-class activities. It reinforced my understanding of the material."	"3 (Neutral)"
Participant 4	"I struggled with keeping up with the pre-reading assignments before class. It felt overwhelming at times."	"1 (Strongly Disagree)"
Participant 5	"The flipped classroom approach made me more accountable for my learning. I felt more responsible for mastering the vocabulary."	"4 (Agree)"

In this table 1:

- The qualitative Responses column includes example open-ended responses from participants regarding their experiences with the flipped classroom approach.
- Quantitative Responses column provides example Likert scale responses (on a scale of 1 to 5) that participants might provide to statements assessing their perceptions and agreement with aspects of the flipped classroom approach.

This data would be collected and analyzed to understand participants' perspectives and experiences with the flipped classroom method in teaching vocabulary and second languages. These questionnaires aimed to explore various facets of the flipped classroom approach, combining qualitative insights with quantitative data to provide a comprehensive evaluation.

### 3.1.2 Procedure

Before the actual learning experiment focused on the flipped classroom approach to teaching vocabulary and second languages, some guidelines were certain steps taken to refine the methods for fairness and comprehension by the participants.

Firstly, self-designed and well-constructed questionnaires ensured systematic data collection with emphasis on qualitative and quantitative characteristics. There were various closed-ended questions developed to allow respondents a set choice of opinions and experiences on the method of the flipped classroom. On the other hand, quantitative posed research questions employed the Likert scale to measure the level of agreement of participants about the perceptions of the efficacy of the innovative teaching methodology.

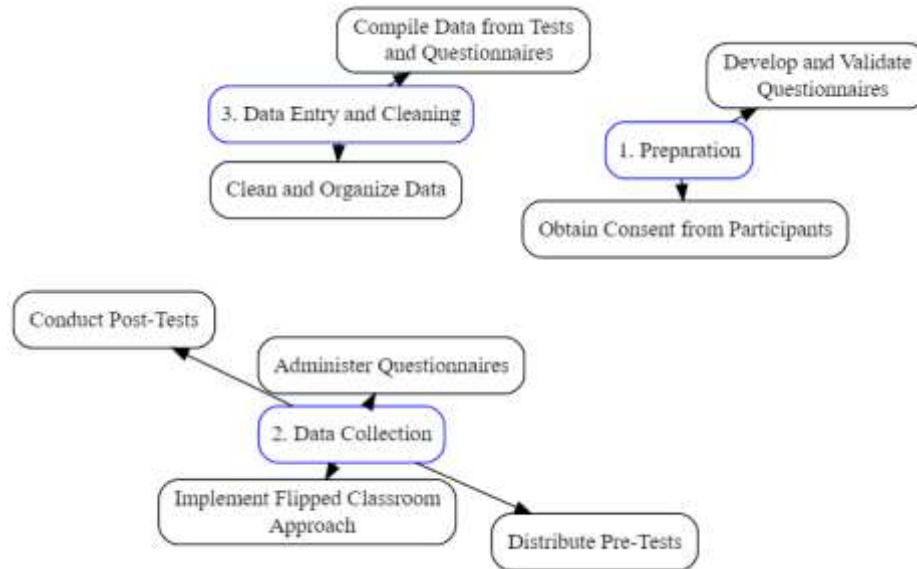
In the same turn, while preparing the pre-study, the participants were very well sensitized about the details of the research, purpose and actual proceedings, and the voluntary nature of participation to avoid any sort of bias. The issue of consent was highly elevated by getting consent forms to ensure that each participant voluntarily and willingly agreed to participate in the studies and the extent of their involvement in the studies.

As for the method of data collection, a systematic approach was used. Finally, before the actual application of the flipped classroom approach, pre-tests were proactively employed to assess the pre-existing vocabulary literacy of participants. In the course of a specific timeframe, a system named flipped classroom was applied in this study, which included the production of teaching videos in the form of installed films for participants to watch as many times as they wanted and complete some related activities independently. Further, online discussions and activities were encouraged to increase the involvement and the intra-communication of the participants. Small group discussions and application activities were done during class to encourage group work, practical exercises, and elucidation of conceptual meanings of difficult vocabularies.

After accomplishing the flipped classroom sessions in the target area, post-tests were used to determine the extent of the students' improved knowledge of vocabulary terms and their ability to store such information in their long-term memories. At the same

time, participants were supposed to fill in a set of extensive questionnaires to obtain their more detailed views and estimations concerning applying the flipped classroom method. These questionnaires were developed carefully for the assessment of the perceived satisfaction, and perceived effectiveness of participants as well as the experience mentored on behalf of using the tender teaching method.

In other words, every stage of the study (Figure 1) was designed and conducted in a very premeditated manner and every procedure and method used to assess the flipped classroom approach was strictly methodologically sound to measure how the approach affects vocabulary learning and knowledge retention in second language acquisition environments.



**Figure 1:** Research Methodology Overview: Flipped Classroom Approach for Vocabulary Acquisition in Second Language Learning

**4. Results and Discussion**

**4.1 Data Analysis**

The columns include demographic information (Urban, Rural, Male, Female) and responses to 20 questions (QUE 1 to QUE 20). The responses are coded with values like "A", "N", "SA", "D", etc (Figure 2).

S/L: No	Urban	Rural	Male	Female	QUE 1	QUE 2	QUE 3	QUE 4	QUE 5	QUE 6	QUE 7	QUE 8	QUE 9	QUE 10	QUE 11	QUE 12	QUE 13	QUE 14	QUE 15	QUE 16	QUE 17	QUE 18	QUE 19	QUE 20
0 1	null	R	null	F	A	A	A	N	N	A	A	SA	A	A	A	A	A	A	A	A	A	A	A	A
1 2	null	R	null	F	A	A	A	N	N	A	A	SA	A	A	A	A	A	A	A	A	A	A	A	A
2 3	null	R	M	null	A	A	D	A	N	D	N	A	A	D	N	D	D	A	A	D	A	A	A	A
3 4	null	R	M	null	N	A	SA	N	D	A	A	N	A	N	A	D	N	N	A	N	D	A	A	A
4 5	null	R	M	null	N	A	SA	N	D	A	A	N	A	N	A	D	N	N	A	N	D	A	A	A
5 6	U	null	null	F	A	SA	SA	A	A	SA	SA	A	SA	SA	SA	A	SA	SA	A	SA	SA	A	SA	SA
6 7	U	null	null	F	A	SA	SA	A	A	SA	SA	A	SA	SA	SA	A	SA	SA	A	SA	SA	A	SA	SA
7 8	null	R	null	F	A	SA	SA	A	A	SA	SA	A	A	SA	SA	A	SA	SA	A	SA	SA	A	SA	SA
8 9	null	R	null	F	A	SA	SA	A	A	SA	SA	A	A	SA	SA	A	SA	SA	A	SA	SA	A	SA	SA
9 10	null	R	null	F	A	SA	N	D	N	SA	A	N	A	N	A	N	A	SA	N	A	D	A	A	A
10 11	null	R	null	F	A	SA	N	D	N	SA	A	N	A	N	A	N	A	SA	N	A	D	A	A	A
11 12	null	R	null	F	A	SA	A	A	A	SA	A	SA	A	A	SA	A	SA	SA	A	SA	D	A	A	A
12 13	U	null	M	null	A	SA	A	A	A	SA	A	SA	A	A	SA	A	SA	SA	A	SA	A	A	A	A
13 14	null	R	null	F	A	SA	SA	A	A	SA	SA	A	SA	SA	SA	A	SA	SA	A	SA	SA	A	SA	SA
14 15	null	R	null	F	A	SA	SA	A	A	SA	SA	A	SA	SA	SA	A	SA	SA	A	SA	SA	A	SA	SA

**Figure 2:** Dataset of the Research

The thematic analysis has identified several key patterns and themes in the responses to the open-ended questions (QUE 1 to QUE 20):

**1. Demographic Patterns:**

- The data is divided into urban (U) and rural (R) areas, as well as by gender (Male and Female).
- The majority of the responses are from rural areas and female respondents.

**2. Response Patterns:**

- The responses are categorized into five levels: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA).
- The distribution of responses varies across the different questions, with some questions eliciting more strongly agreeing or disagreeing responses, while others have a more balanced distribution.

**3. Prevalent Themes:**

- *Positive Sentiment:* Many responses indicate a positive sentiment, with a high proportion of "Agree" and "Strongly Agree" responses across various questions.
- *Neutral Stance:* Some questions elicit a more neutral stance, with a significant number of "Neutral" responses.
- *Negative Sentiment:* A few questions show a higher proportion of "Disagree" and "Strongly Disagree" responses, indicating a more negative sentiment.

**4. Specific Insights:**

**Question-specific Patterns:**

- For some questions (e.g., QUE 4, QUE 6, QUE 9, QUE 14), there is a higher proportion of "Strongly Agree" responses, suggesting a strong positive sentiment towards those topics.
- Other questions (e.g., QUE 3, QUE 7, QUE 17) have a more balanced distribution of responses, indicating a mix of opinions.
- A few questions (e.g., QUE 2, QUE 5, QUE 13) show a higher proportion of "Disagree" and "Strongly Disagree" responses, suggesting a more negative sentiment towards those topics.

**5. Demographic Differences:**

- The data suggests some differences in response patterns between urban and rural areas, as well as between male and female respondents.

**4.2 Frequency Count**

Quantitative data analysis, starting with descriptive statistics to calculate the frequencies and percentages of responses to the Likert-scale items.

	QUE 1	QUE 2	QUE 3	QUE 4	QUE 5	QUE 6	QUE 7	QUE 8	QUE 9	QUE 10	QUE 11	QUE 12	QUE 13	QUE 14	QUE 15	QUE 16	QUE 17	QUE 18	QUE 19	QUE 20
SA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 3: Frequency Count



4.3 Percentage Count

	QUE 1	QUE 2	QUE 3	QUE 4	QUE 5	QUE 6	QUE 7	QUE 8	QUE 9	QUE 10	QUE 11	QUE 12	QUE 13	QUE 14	QUE 15	QUE 16	QUE 17	QUE 18	QUE 19	QUE 20
A	61.46789	45.87156	44.95413	43.11927	50.45872	35.77982	49.54128	32.11009	46.78899	47.70642	48.62385	50.45872	35.77982	39.44954	47.70642	37.61468	53.21101	32.11009	48.62385	35.77982
D	1.834862	1.834862	4.587156	19.26606	11.00917	3.669725	1.834862	1.834862	11.92661	2.752294	0.917431	4.587156	5.504587	2.752294	2.752294	3.669725	11.92661	4.587156	2.752294	0.917431
N	5.504587	2.752294	15.59633	15.59633	16.51376	3.669725	4.587156	6.422018	13.76147	8.256881	6.422018	16.51376	9.174312	3.669725	12.84404	11.92661	4.587156	18.34862	5.504587	11.92661
SA	22.01835	41.2844	21.10092	5.504587	11.92661	44.95413	34.86239	51.37615	15.59633	32.11009	35.77982	20.18349	41.2844	45.87156	25.68807	37.61468	20.18349	34.86239	32.11009	42.20183
SD	0.917431	0	1.834862	8.256881	1.834862	3.669725	0	0	3.669725	0	0	0	0	0	0	0.917431	0	0.917431	0.917431	0
1	0.917431	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0.917431	0	0.917431	0.917431	0.917431
2	0.917431	0.917431	0.917431	0	0.917431	0	0.917431	0.917431	0	0	0	0	0	0	0	0	0	0	0	0
6	0.917431	0	0	0.917431	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0.917431
67	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0.917431	0.917431	0	0.917431	0.917431	0.917431	0	0.917431	0.917431	0	0.917431	0.917431	0.917431	0.917431	0.917431	0	0.917431	0	0	0
0	0	0.917431	0	0	0	0	0.917431	0.917431	0	0.917431	0.917431	0.917431	0.917431	0.917431	0.917431	0	0.917431	0	0	0.917431
3	0	0.917431	0	0	0	0	0	0	0	0.917431	0.917431	0.917431	0.917431	0.917431	0.917431	0	0.917431	0	0	0.917431
50	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0
45	0	0.917431	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0
5	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0.917431	0	0	0	0.917431	0	0	0	0	0.917431	0	0	0	0	0.917431	0.917431	0	0
17	0	0	0.917431	0.917431	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0.917431	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0.917431	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0
21	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0.917431	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0
55	0	0	0	0	0.917431	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0.917431	0	0	0	0.917431	0	0	0	0	0	0	0.917431	0.917431	0	0	0.917431
4	0	0	0	0	0	2.752294	0	0	0.917431	0	0	0	0	0.917431	0	0.917431	0	0	0	0
39	0	0	0	0	0	0.917431	0	0	0	0	0.917431	0	0.917431	0	0	0	0	0	0	0.917431
54	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0	0.917431	0
99	0	0	0	0	0	0	0.917431	0	0	0.917431	0	0	0	0	0	0.917431	0.917431	0.917431	0	0.917431
7	0	0	0	0	0	0	0	0.917431	0	0.917431	0	0.917431	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0.917431	0	0.917431	0	0	0	0	0	0	0	0	0.917431	0.917431
56	0	0	0	0	0	0	0	0.917431	0	0.917431	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0.917431	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0	0	0.917431
22	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0.917431	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0.917431	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0	0.917431	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.834862	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431	0	0
SAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.917431

Figure 4: Percentage Count

- **Frequency Count:** Figure 3 shows the number of responses for each Likert scale option (A, D, N, SA, SD) across all questions.
- **Percentage Count:** Figure 4 shows the percentage of responses for each Likert scale option across all questions.

Here are the visualizations of the frequency and percentage counts of responses:

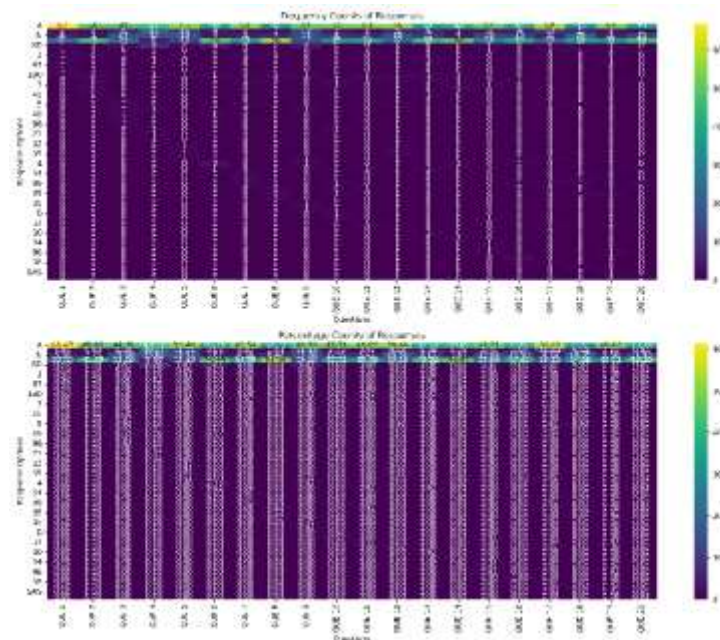


Figure 5: Visual Representation of the Distribution of Responses



The heatmaps (Figure 5) provide a clear visual representation of the distribution of responses across different questions. The first heatmap shows the frequency counts, while the second heatmap shows the percentage counts. It seems some non-numeric values in the dataset are causing issues with the correlation calculation.

1	[4.0, 5.0, 3.0, 2.0, nan, 0.0, 50.0, 45.0, 100.0]
2	[4, 2, 5, 3, nan, 5, 1, 17, 40, 23, 96]
3	[3.0, 4.0, 2.0, 5.0, 1.0, nan, 8.0, 21.0, 17.0, 47.0, 6.0, 100.0]
4	[3.0, 2.0, 4.0, 5.0, 1.0, nan, 12.0, 18.0, 55.0, 13.0, 100.0]
5	[4.0, 2.0, 5.0, 3.0, 1.0, nan, 38.0, 49.0, 100.0]
6	[4.0, 3.0, 5.0, 2.0, nan, 0.0, 54.0, 38.0, 99.0]
7	[5.0, 4.0, 3.0, 2.0, nan, 0.0, 7.0, 35.0, 56.0, 100.0]
8	[4.0, 5.0, 2.0, 3.0, 1.0, nan, 13.0, 15.0, 51.0, 17.0, 100.0]
9	[4, 2, 3, 5, 0, nan, 0, 9, 52, 35, 99]
10	[4.0, 3.0, 5.0, 2.0, nan, 0.0, 1.0, 7.0, 53.0, 39.0, 100.0]
11	[4.0, 2.0, 3.0, 5.0, nan, 0.0, 18.0, 55.0, 22.0, 100.0]
12	[4.0, 2.0, 3.0, 5.0, nan, 0.0, 6.0, 10.0, 39.0, 45.0, 100.0]
13	[4.0, 3.0, 5.0, 2.0, nan, 0.0, 43.0, 50.0, 100.0]
14	[4.0, 3.0, 2.0, 5.0, nan, 1.0, 14.0, 52.0, 28.0, 98.0]
15	[4.0, 2.0, 3.0, 5.0, nan, 0.0, 13.0, 41.0, 99.0]
16	[4.0, 2.0, 5.0, 3.0, 1.0, nan, 13.0, 58.0, 22.0, 98.0]
17	[4.0, 2.0, 3.0, 5.0, nan, 1.0, 20.0, 35.0, 38.0, 99.0]
18	[4, 2, 5, 3, nan, 1, SAS, 0, 53, 35, 88]
19	[5.0, 3.0, 4.0, 2.0, nan, 0.0, 1.0, 13.0, 39.0, 46.0, 99.0]

Figure 6: Inspection of the data to Identify Non-numeric Values and Clean Values

The unique values in each column reveal that there are non-numeric values such as "S", "G", and "SAS" present in the dataset. These need to be handled before we can proceed with the correlation calculation (Figure 6).

#### 4.4 Correlation Matrix

Now clean the data by converting non-numeric values and then proceed with the correlation calculation.

QUE 1	QUE 2	QUE 3	QUE 4	QUE 5	QUE 6	QUE 7	QUE 8	QUE 9	QUE 10	QUE 11	QUE 12	QUE 13	QUE 14	QUE 15	QUE 16	QUE 17	QUE 18	QUE 19	QUE 20
1	0.969656	0.9813	0.94474	0.978418	0.942732	0.984274	0.918782	0.975881	0.984136	0.981492	0.986201	0.9475	0.948621	0.986778	0.958316	0.989919	0.941291	0.985942	0.946567
0.969656	1	0.969273	0.906624	0.941312	0.991091	0.995363	0.983128	0.952286	0.991789	0.99561	0.965097	0.991157	0.995034	0.980495	0.990025	0.967632	0.97435	0.993569	0.989217
0.9813	0.969273	1	0.964432	0.986834	0.953978	0.980363	0.937313	0.988843	0.986401	0.981739	0.995013	0.968087	0.956341	0.993956	0.977111	0.983342	0.975586	0.98524	0.966888
0.94474	0.906624	0.964432	1	0.983933	0.892627	0.924731	0.861587	0.982147	0.936013	0.923357	0.964787	0.912432	0.890229	0.953161	0.92136	0.966201	0.925666	0.934281	0.902132
0.978418	0.941312	0.986834	0.983933	1	0.920922	0.960344	0.895587	0.990451	0.968629	0.958852	0.990879	0.937724	0.922934	0.981489	0.950319	0.984697	0.950084	0.965458	0.933467
0.942732	0.991091	0.953978	0.892627	0.920922	1	0.981442	0.992043	0.935905	0.978926	0.983476	0.945332	0.993027	0.9952	0.964975	0.989996	0.946224	0.978204	0.978825	0.992199
0.984274	0.995363	0.980363	0.924731	0.960344	0.981442	1	0.969076	0.965426	0.995859	0.997326	0.979113	0.983389	0.986204	0.989292	0.98756	0.979891	0.972264	0.997147	0.982686
0.918782	0.983128	0.937313	0.861587	0.895587	0.992043	0.969076	1	0.912389	0.967055	0.972815	0.929304	0.989806	0.992436	0.950055	0.984517	0.922864	0.975228	0.96498	0.991262
0.975881	0.952286	0.98843	0.982147	0.990451	0.935905	0.965426	0.912389	1	0.974516	0.966289	0.988108	0.951553	0.937282	0.984242	0.961133	0.985701	0.959922	0.973983	0.944296
0.984136	0.991789	0.986401	0.936013	0.968629	0.978926	0.995859	0.967055	0.974516	1	0.996377	0.986274	0.984987	0.982807	0.993357	0.990384	0.982887	0.979078	0.996417	0.984048
0.981492	0.99561	0.981739	0.923357	0.958852	0.983476	0.997326	0.972815	0.966289	0.996377	1	0.979162	0.985758	0.987917	0.990005	0.989692	0.977739	0.976269	0.996545	0.986413
0.986201	0.965097	0.995013	0.964787	0.990879	0.945332	0.979113	0.929304	0.988108	0.986274	0.979162	1	0.961661	0.950393	0.99348	0.971858	0.98561	0.968607	0.98328	0.960149
0.9475	0.991157	0.968087	0.912432	0.937724	0.993027	0.983389	0.989806	0.951553	0.984987	0.985758	0.961661	1	0.993758	0.97446	0.995226	0.955082	0.989422	0.983535	0.995347
0.948621	0.995034	0.956341	0.890229	0.922934	0.9952	0.986204	0.992436	0.937282	0.982807	0.987917	0.950393	0.993758	1	0.968575	0.989573	0.950054	0.976699	0.983039	0.99246
0.986778	0.980495	0.993956	0.953161	0.981489	0.964975	0.989292	0.950055	0.984242	0.993357	0.990005	0.99348	0.97446	0.968575	1	0.983921	0.984988	0.977043	0.991478	0.974629
0.958316	0.990025	0.977111	0.92136	0.950319	0.989996	0.98756	0.984517	0.961133	0.990384	0.989692	0.971858	0.995226	0.989573	0.983921	1	0.962308	0.991816	0.986916	0.995007
0.989919	0.967632	0.983342	0.966201	0.984697	0.946224	0.979891	0.922864	0.985701	0.982887	0.977739	0.98561	0.955082	0.950054	0.984988	0.962308	1	0.950972	0.98381	0.949585
0.941291	0.97435	0.975586	0.925666	0.950084	0.978204	0.972264	0.975228	0.959922	0.979078	0.976269	0.968607	0.989422	0.97699	0.977043	0.991816	0.950972	1	0.974551	0.989812
0.985942	0.993569	0.98524	0.934281	0.965458	0.978825	0.997147	0.96498	0.973983	0.996417	0.996545	0.98328	0.983535	0.983039	0.991478	0.986916	0.98381	0.974551	1	0.98136
0.946567	0.989217	0.966888	0.902132	0.933467	0.992199	0.982686	0.991262	0.944296	0.984048	0.986413	0.960149	0.995347	0.99246	0.974629	0.995007	0.949585	0.989812	0.98136	1

Figure 7: Correlation Matrix Calculation

The correlation matrix has been successfully calculated. It shows the correlation coefficients between each pair of questions (QUE 1 to QUE 20). The values range from -1 to 1, where 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation (Figure 7).

## 5. Conclusion

Finally, this research is a clear indication of the positive effects of the flipped classroom approach to facilitate the teaching of vocabulary and to improve second language acquisition in Bangladesh. The current study thus, using an empirical survey involving research papers and surveys along with thematic analysis of data gathered from tertiary-level students, proves that the flipped classroom model can enhance the learning of vocabularies. It has been found that the model provides students with more autonomy in their learning and also encourages more fascinating and effective activities in the classroom. Nonetheless, the use of the old approach means that some of the difficulties in implementing the new approach might be faced and might need adjustments to solve them, for instance, internet connection for assignments or group work. However, it can be concluded that even though the concept of the flipped classroom model does not work for all types of instruction, there is a high potential for the application of this idea in vocabulary teaching. The analysis of the survey data reveals that there are numerous positive connections with this method because it has general acceptance and efficacy. Overall, educators need to find out whether Bangladeshi students can grasp all forms and techniques used in blended learning and how to make all necessary adjustments. In conclusion, this study emphasizes the effectiveness of the flipped classroom approach in enhancing the development of vocabulary as well as offers useful solutions to using the method in the educational processes in Bangladesh.

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