Difficulties in Applying the Flipped Learning Method in the Philippines' Mountainous Areas

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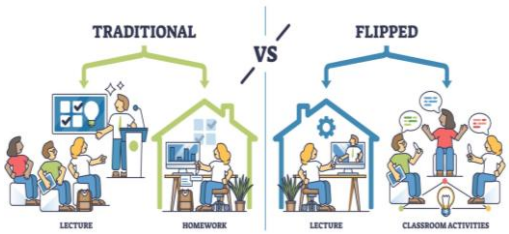
Abstract:

In a mountainous area of the Philippines, this study investigated how flipped learning affected general science competencies in elementary education and IT students. The pedagogical intervention comprised synchronous in-class activities focused on application and group discussion, followed by taped video lectures for autonomous asynchronous study. A pre- and post-tests design was utilized to assess student competences, which measured their capacity to recognize, evaluate, and elucidate scientific concepts. Surprisingly, after the intervention, student performance did not alter in away that was statistically significant ($p > 0.05$). The results indicate that although the flipped approach works well in settings with abundant resources, it is not appropriate for students in mountainous areas who have systemic obstacles including "energy poverty," inconsistent internet connectivity, and significant budgetary limitations. These elements significantly reduced participation in technology-mediated learning, indicating that a reliance on such resources may inadvertently exacerbate existing educational inequalities. The study underscores the imperative for contextually informed, "offline-first" pedagogical strategies tailored to rural and geographically isolated contexts.

Keywords: Flipped Learning, Remote Education, Educational Challenges, Digital Divide, Rural Pedagogy, Philippines

INTRODUCTION

With more than 7,000 islands, the Philippines archipelago offers a complicated physical framework where mountainous areas frequently experience systematic educational marginalization. While isolates highlands still face “last mile” obstacles that restrict egalitarian learning, urban areas like Manila and Cebu City benefit from quick technological integration and %G connectivity. The viability of the flipped learning methodology in the particular resource constrained setting of a mountain satellite school is examined in this study. Flipped learning, made famous by Bergmann and Sams (2012), reorganizes the traditional classroom by shifting direct instruction-typically through digital media outside of scheduled class times, turning synchronous class time into a setting for group problem-solving. According to recent research, when this approach is adapted to particular academic fields, it can improve student’s self-efficacy (Sun etal., 2023). But the model rests on the fundamental assumption that students possess the "digital capital"—hardware, connectivity, and electricity—to engage with content independently.



Global literature provides strong evidence that flipped learning can promote self regulation and enhance academic competence (O'Flaherty & Philipis, 2015). This approach transfers the responsibility of foundational learning to the learner by enabling flexible engagement with the material. The concept is acknowledged for its usefulness in preserving educational continuity during disturbances like COVID-19 pandemic, going beyond simple academic accomplishment (Purba et al., 2021). Flipped learning's application in the Philippine highlands is still understudied despite worldwide trend. One major obstacle is the "digital divide"," which is defined by intermittent power, outdated gear, and exorbitant mobile date costs (OpenGov Asia, 2025). By investigating how these systemic disparities affect general science competencies in a rural university setting, our study closes this gap.

Literature Review

2.1. Conceptual Structure: The Flipped Shift

By moving lecture -based content to the pre-class phase, the flipped learning paradigm reorganizes conventional instructional hierarchies (Chen et al., 2014) This change is meant to promote both a high engagement collaborative practice and self-paced solidarity study environment. Theoretically, this accommodates different learning speeds by enabling students to pause, rewind, and review lectures.

2.2. Verified Benefits in Resource-Rich Environments

Research indicates that this strategy is associated with increase student motivation and more significant teacher-student relationships (Arnold-Garza, 2014). The instructor can use the "surplus" of class time to address certain learning gaps and conduct diagnostic assessments.

2.3. The "Pre-class Burden" Barrier

A student's intrinsic motivation and availability to digital resources are critical factors in their success (Alkhouja & Al-Tarawneh, 2024). One common issue is "under-preparation,' in which students are unable to participate in advanced in-class tasks because they do not interact with the pre-recorded materials (Herreis & Schiller, 2013). This "failure to prepare" in rural locations is frequently due to infrastructure rather than motivation.

2.4. The Mountainous Setting: An Important Research Void

The flipped classroom has been shown effective in technologically advanced metropolitan settings, but there is a dearth of data on how well it works in remote highlands. The way that the "digital divide" interferes with the flipped model's working is mostly ignored in current studies (Cabansag & Pakingan 2024). This research fills the gap by examining how environmental constraint necessitate localized equitable pedagogical strategies.

Methodology

3.1. Research Design

The flipped classroom approach was evaluated using quantitative pre-experimental phase (pre-test/post-test for a single group. Forty-nine (49) students from CTU-CCMSC's Bachelor of Elementary Education (BEED) and Bachelor of Information Technology (BIT) programs from 2019-2020 academic year made up the cohort.

3.2. Instrumentation and Intervention

In order to participate in their intervention, students had to use mobile devices to watch lectures on general science that had already been taped before class. Collaborative problem-solving was the focus of synchronous sessions. The three main competencies were tested by the assessment:

1. Chronological Identification: Charting scientific progress
2. Comparative Analysis: Differentiating across technical progression era.
3. Critical Evaluation: Outlining the importance of science to society

3.3 Statistical Analysis

The performance baseline was determined using descriptive statistics (means and standard deviation). Iorder to assess the mean gain's statistical significance, a Z-test was applied.

Results And Analysis

4.1. Demographics of Participants

Males greatly outnumbered girls (28 to 13), and the distribution of the 49 participants revealed a strong concentration in the BIT-1 program (41 students). The BEED-2 cohort was smaller (8 students) and mostly female. 85.7% of students were enrolled full-time, while 79.6% of students were between the ages of 17 and 21.

4.2. Results of Performance

A sobering reality was shown by the quantitative facts. Every pre- and post-tests mean score stated in the "Below Average" (BA) range

Competency	**Pre-test Mean**	**Post-test Mean**	**Gain**	**Verbal Description**
Identifying	16.06	17.24	+1.18	Below Average
Analyzing	11.43	12.14	+0.71	Below Average
Explaining	2.08	2.31	+0.23	Below Average
Grand Mean	**9.86**	**10.56**	**+0.70**	**Below Average**

4.3 Significance in Statitics

The improvements were not statistically significant, according to the Z-test fro mean gain ($Z<1.96$).

Identifying: $Z = 1.47$

Analyzing: $Z = 1.34$

Explaining: $Z = 1.22$

This findings show that, in this situation, there was no noticeable effect of the flipped classroom intervention on students' learning.

Discussion

The results of this investigation differ significantly from the favorable outcomes documented in international literature. The infrastructure needed to support the pedagogy is failing, not the pedagogy itself, which is why it hasn't improved.

5.1. The Incompatibility of Infrastructure and Pedagogy

The flipped approach assumes that the "learning" happens at home and the 'doing" happens at school. Energy poverty is a common feature of the "home" setting in Cebu's hilly areas. In order to charge their devices, students reported going kilometers to the lowlands. The digital lecture cannot be accessed without electricity, which makes the ensuing in-class exercise useless.

5.2. Socioeconomic Obstacles

Financial resources are crucial fro survival in the farming backgrounds of many pupils. A 1GB data promo, which is necessary fro streaming video lecture, might cost a significant portion of a family's daily budget. Consequently, the "flipped" approach inadvertently places a financial tax on education, widening the gap between those who can afford data and those who cannot.

Conclusion

Technology dependent innovations cannot be "wired and played" into surroundings with limited resources, as CTU-CCMSC's flipped classroom implementation showed. Hardware incompatibility and widespread poverty negated the model's reliance on "outside-of-class" internet interaction. Strong investments in rural digital infrastructure must come before technology-enhanced learning can be equitable areas. This study serves as a crucial warning: even the most "new" teaching strategies could further isolate the underprivileged in the absence pf a foundation of digital equity.

Recommendations

1. Give "Offline-First" Models Priority: Provide materisl via pre-loaded SD card or USB devices that don't require active internet in place of streaming.
2. Create Community Learning Hubs: Local barangay halls and schoolsshould collaborate to provide solar-powered charging stations and Wi-Fi hotspots.
3. Subsidized Educational Hardware: Government programs should concentrate on giving students in mountainous are as low-power tablets.
4. Contextualized Teacher Training: Teachers need to be prepared to create "low-bandwidth" flipped model using printed modular materials and sporadic digital touchpoints.

LIMITATIONS

The results are restricted to the particular socioeconomic and geographic circumstances of the CTU-CCMSC campus in 2019-2020. The generalizability to other fields or areas with stronger infrastructure may be limited by the small sample size (n=49) and the particular focus on general science.

Future Researchers

Future studies should concentrate of the following crucial areas in order to expand on these important discoveries and aid in the creation of more inclusive and successful teaching methods in difficult settings:

- Evaluating the viability and efficacy of modified or hybrid flipped classroom models that specifically incorporate low-tech solutions, offline materials delivery (such as pre-loaded content on flash drives, printed workbooks), or community-based learning hubs intended to get around ongoing connectivity problems.
- Longitudinal Studies: Carry out longer term research to see if students' adjustment to new learning modalities, along with possible progressive advancements in local digital infrastructure, will eventually result in more favorable and long-lasting learning outcomes.
- Qualitative and Mixed Method Approaches: To obtain a more nuanced picture of student and teacher experiences, perspectives, and coping mechanisms in these difficult circumstances, use in-depth qualitative methods (e.g., focus groups, ethnographic studies, in-depth interviews). Even deeper, more thorough insights could be obtained by a strong mixed-methods approach that combines quantitative and qualitative data.
- Teacher Preparedness and Support: Examine the particular training requirements, models of professional development, and continuing support systems needed for teachers to successfully integrate technology-enhanced learning in locations with limited resources. This entails assessing their degree of self-assurance, computer literacy, and pedagogical flexibility.
- Policy Impact Studies: Assess the practical efficacy of government and non-governmental organization (NGO) efforts to close the digital divide (such as rural internet rollouts and device provision programs) and their direct, quantifiable influence on educational outcomes in remote areas.
- Cost-Benefit Analysis: Provide empirical evidence fro resource allocation decisions of various interventions intended to enhance technology access, infrastructure, support services in these neglected areas.

The academic community may work together to establish more comprehensive, inclusive, and ultimately successful educational practices for every child, irrespective of where they live or their financial status, by methodically tackling these possibilities fro future research.

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