

Mathematics Teacher's Perceptions of Flipped Classroom Approach towards Digital Literacy Skills

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ABSTRACT

Background: With respect to developing digital literacy, vast innovations have emerged in the field of education, including the learning-teaching process in the 21st -century. **Methods:** When addressing the competencies of the 21st -century, teachers should be aware of the new blended teaching methods as they are the pioneers in guiding the students towards the future of our nation. The flipped classroom (FC) approach is one of the popular pedagogical practices providing opportunities for students to encounter digital literacy experiences in the 21st -century. Hence this study was launched to find out the mathematic teachers' perceptions of FC towards digital literacy skills in students. This study adopted a mixed method design; the data was collected using a questionnaire and interview. The attitude scale questionnaire was administered to 244 mathematics teachers, from the Galle education division using a purposive sampling method and 10 randomly selected mathematics teachers from the total sample size were interviewed by the researcher for an in-depth investigation. Data were analyzed quantitatively using SPSS (Version 25) software and qualitatively using thematic analysis. **Results:** The result showed that most of the sample was in the view that the FC approach can promote teachers to become organizers of information literacy. Also, most teachers agreed that the FC approach can communicate students' ideas with each other by utilizing multiple media and technologies. **Conclusion:** Findings also revealed that there were statistically significant differences in teacher perceptions due to gender in imparting digital literacy skills through FC. The study results demonstrated that the sample was aware of the importance of the FC approach. Therefore, practice-oriented strategies should be used to improve mathematics teacher implementation in Sri Lanka.

Keywords: *Mathematics Teacher; Flipped Classroom (FC); Digital Literacy Skills*

1. Background

With the surge of technology in educational practice due to a new paradigm, the development of skills in digital literacy has grown more important in the learning and teaching process (Upadhyay & Mohammed, 2022). In brief, digital literacy is the ability to interpret and apply information in a variety of formats from a variety of sources when delivered via computer ethically and responsibly (Gister, 1997). According to the P21 framework, digital literacy skills consist of Information Literacy, Media Literacy, and ICT (Information, Communications, and Technology) Literacy.

The interaction of technology, pedagogy, and perceptions of teachers produces the types of flexible context in every teacher needs to meaningfully integrate technology in the practice of teaching and learning process (Novita & Herman, 2021). The inclusion of technology in teaching and learning has thus taken on different terminologies including e-learning, blended learning, online learning, virtual learning, and technology-enhanced pedagogy. In the modern era, Mathematics teachers are focusing their attention on blended learning teaching models that use appropriate technology to improve digital literacy skills. Among them, the flipped classroom (FC) approach is a popular pedagogical practice in mathematics, providing opportunities for enhancing digital literacy skills to learn anywhere and at their own pace.

According to Jang & Kim, (2020), student’s engagement during pre-class activities and in-class activities plays a significant role in achieving high learning outcomes in the flipped classroom model towards enhancing learning achievement. In 2015, Bezemer and Kress stated that the flipped classroom environment has been transformed into a more active, participatory environment and improving. Yang (2017) points out that teachers' perceptions and awareness are more important for the success of the flipped classroom in secondary school. Furthermore, Johnson, Johnson & Smith (2014) revealed flipped classroom approach has empowered students' digital literacy skills.

It is against such a background that this study was undertaken to explore the perceptions of mathematics teachers of the flipped classroom approach in secondary schools in Sri Lanka. Therefore, the main purpose of the research is to determine what are the perceptions of Sri Lankan mathematics teachers on the flipped classroom approach towards digital literacy skills in students for the 21st century.

1.1 Specific Objectives

This study was undertaken to:

1. Find out the mathematic teacher’s perceptions of the flipped classroom approach Towards the digital literacy skills in students.
2. Identify the barriers for mathematics teachers to enhance the experience in the flipped classroom approach.

2. Methods

This study is a descriptive study based on the two-phase mixed method. In the first phase (quantitative phase) Likert scale questionnaire was used to find out the mathematic teachers’ perceptions of the flipped classroom approach towards the digital literacy skills in students. In the second phase, a face-to-face interview was conducted with randomly selected 10 mathematics teachers from the sample. The use of these tools enabled the researcher to validate the study results and get more reliable findings. To construct the Likert-scaled questionnaire, the components of digital literacy skills exposed by the P21 framework (2019) were initially considered. The survey questionnaires were distributed to 244 mathematics teachers with pre-training in the FC from secondary schools classified as 1 AB, 1C, and Type 2 schools in Galle zonal educational division under a purposive sampling method.

Table 1: Sample of the Teachers

Types of School	Numbers of Teachers		Total
	Male	Female	
1AB	31	97	128
1C	22	48	70
Type 2	31	15	46
Total	84	160	244

The quantitative data collected through the questionnaire were analyzed using the Statistical Package

for the Social Sciences (SPSS: Version 25). Means, frequencies, standard deviations, t-tests for independent samples, and One-Way Analysis of Variance (ANOVA) were used to find out descriptive statistical analysis.

3. Results and Discussion

The key findings in this study are in line with the following: Perceptions of the flipped classroom approach towards the digital literacy skills in students and barriers that mathematics teachers face to enhance the experience in the flipped classroom approach.

3.1 Perceptions of Flipped Classroom Approach Towards Digital Literacy Skills

The result showed that the majority of the teacher’s sample was in the view that the flipped classroom approach can monitor student creativity when learning mathematics. Furthermore, 78.3% of the sample agreed that the flipped classroom approach enables students to build knowledge outside the classroom and 82.1% of teachers agreed that students can communicate their ideas with each other using multiple media and technologies. The interview with teachers in the sample revealed that encouraging the use of technology in learning mathematics through the flipped classroom approach can move students to achieving information autonomously.

The result showed that 78% of the sample was in the view that the flipped classroom approach can promote teachers to become organizers of information literacy. Furthermore, 80.7% of the sample revealed that the flipped classroom approach promotes both teacher and student’s computer literacy skills. 86.4% of the teachers in the sample revealed that the flipped classroom approach to improving access to information through technology provides a digital solution to the problem of insufficient 40-minute time in classrooms in Sri Lanka.

Interview results also revealed that a minority of mathematics teachers allowed students to use laptop computers for learning–teaching process and even involved them in deciding the topics of the mathematics lessons for which technical tools can be used. Generally, teachers used a simple massaging platform: WhatsApp groups in the pre-learning concept in FC depending on the need and facilities available.

The statistical ANOVA-test results indicate that there were statistically significant differences between the currently working school type of mathematics teachers and the perceptions of mathematics teachers towards digital literacy skills enhanced by the flipped classroom approach as shown in Table 2, $F=3.409$, $p=0.010 < 0.05$.

Table 2: ANOVA- Test of Mathematics Teachers’ Perceptions Towards Digital Literacy Skills Through FC Approach Based on School Type

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.148	2	0.074	3.409	0.010
Within Groups	40.213	241	0.167		
Total	40.361	243			

The results of the interviews with the teachers revealed that according to the classification of schools in Sri Lanka, the provision of technical facilities and equipment to individual schools is unbalanced and that phenomenon affects the improvement of students' digital literacy skills through the flipped classroom approach. Also, the results of the interviews with the mathematics teachers revealed that according to the classification of schools in Sri Lanka, the provision of currently updated technical facilities and equipment to individual schools is unbalanced and that phenomenon affects the improvement of students' digital skills through the FC approach. Furthermore, it can identify uncooperative administrative applications, inadequate teacher training and lack of refresher courses as obstacles to implementing the FC approach.

In addition, interview results clearly showed that students' attitudes strongly hindered the implementation of the FC approach to create an autonomous learning culture for students.

Furthermore, the quantitative result of T- test presented in Table 3 shows that the Sig (2-2-tailed) value is 0.00 which is less than 0.05. This implies that there is a significant difference in teachers' perceptions due to gender in imparting digital literacy skills through FC.

Table 3: T-test for Independent Samples of Mathematics Teachers' Perceptions towards the Digital Literacy Skills by FC Approach due to Gender

<i>Teachers' perceptions Towards Flipped Classroom (FC)</i>	Gender	N	Mean	S. D	T	Sig.*
Total	Male	84	2.3876	0.42894	4.310	0.000
	Female	160	2.1590	0.37377		

*The mean difference is significant at the 0.05 level

Comparing the means and standard deviations of teachers' perceptions regarding gender shows apparent differences between the males and the females in their perceptions of FC. According to Table 3 descriptive statistics for the study groups indicate the value of p is 0.000, which is less than 0.05. It has been revealed that there is a significant difference between the mean of perceptions of male and female mathematics teachers towards digital literacy skills. The results of the interviews with female teachers revealed that inadequate teacher training on technical skills and disability to manipulate technological equipment were affect the improvement of students' digital literacy skills.

On the other hand, 61.2% of the sample disagreed that students become independent from the teacher in the FC, as students acquire a (big data) large amount of information through technology and engage in critical thinking before entering the classroom. In exploring the reasons for this perception, the interview results revealed that teachers in Sri Lanka still prioritize teaching over learning in the classroom. Furthermore, they stated that teachers need to control the prior knowledge acquired by students before entering the classroom through the Internet and computer applications.

The results of the study revealed the importance of teachers' and students' ability to use computers, social media, and related resources to implement flipped classrooms to develop digital literacy skills for students (DeLozier & Rhodes, 2017). However, it was revealed that weak internet connection, lack of knowledge of social platforms, limited resources, insufficient technological tools, and student attitude make discouraged implementing the flipped classroom in Sri Lankan schools. Other problems highlighted by teachers for implementing the FC approach in classes were non-cooperative administrative applications, inadequate teacher training, workshops, and refresher courses for teachers to update their knowledge related to FC approach.

4. Conclusions and Recommendations

The key findings in this study are in line with the following: Awareness of the importance of flipped classroom approach, statistically significant differences by Gender and statistically significant differences by current workplace. A detailed presentation of the key findings is hereby offered below:

4.1 Awareness of the Importance of FC Approach

The study results demonstrated that the mathematics teachers of the sample were aware of the importance of the FC approach towards the digital literacy skills aligns with existing literature. Numerous studies have underscored the effectiveness of the FC approach in enhancing digital literacy skills. This alignment suggests that educators are increasingly recognizing the potential benefits of the FC approach in promoting digital literacy among students. For instance, research by Johnson, Johnson & Smith (2014) highlighted that educators perceive the FC model as a valuable tool for improving students' digital literacy.

4.2 Statistically Significant Differences by Gender

The study found statistically significant differences in teachers' perceptions of the flipped classroom approach's impact on digital literacy skills based on gender. This outcome is consistent with prior research that has explored gender differences in technology-related fields. Several studies, such as those by Milenkova, and Manov (2019) have reported gender disparities in technology-related attitudes and skills, with males often expressing more confidence and positive perceptions. This suggests that gender-related differences in digital literacy perceptions may be a broader phenomenon that extends to educational contexts.

4.3 Statistically Significant Differences by Current Workplace

Additionally, the study identified statistically significant differences in teachers' perceptions of the FC approach based on their current workplace. This finding underscores the impact of the educational environment on teachers' attitudes and perceptions. Previous literature, as discussed by Berić-Stojšić *et al.*, (2020), has highlighted how the institutional context can influence educators' willingness to adopt innovative teaching methods, such as the flipped classroom approach. This aligns with the idea that teachers in different workplace settings may have varying levels of exposure and support for technology integration and digital literacy initiatives.

In conclusion, the study's results provide valuable insights into mathematics teachers' perceptions of the FC approach's impact on digital literacy skills. These findings are supported by prior literature, which underscores the growing awareness of the importance of the FC approach in enhancing digital literacy. Furthermore, the identification of gender and workplace-related differences in perceptions highlights the need for tailored strategies and support to promote digital literacy in diverse educational settings.

Therefore, practice-oriented strategies should be used to improve mathematics teacher implementation in Sri Lanka. Considering the result of the present study, the researcher recommended the following,

- By changing the perceptions of the teachers, the concern about the lack of technology can be reoriented and simple learning management systems, worksheets based on textbooks, or a study guide can be introduced as alternative suggestions.
- Appropriate strategies should be developed to improve teacher training in the flipped in Sri Lanka.
- Develop state policies that require the direct sharing of resources with other enriching schools that have technological resources.
- Organizing oriented workshops by the Ministry of Education to train teachers on how to employ FC approach for teaching mathematics.
- Providing teachers with adequate opportunities and appropriate motivation to practice the FC approach in their classes.
- Encouraging teachers to conduct action research studies that examine the impact of the FC approach on the achievement of digital literacy skills.

5. Declarations

5.1 Ethics Approval and Consent to Participate: In the data collection process, electronically informed consent was obtained from the participants.

5.2 Conflict of Interests: Not applicable

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