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Impact of Flipped Teaching on Students' Performance at School Level in India in the Context of Different Medium/s of Instruction

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ABSTRACT

The objective of this research was to examine the impact of flipped teaching in comparison with traditional/regular teaching method between two different mediums (English and Odia/vernacular) in secondary level schools. The study includes science-teaching classes to find out the effect of the teaching methods. In total, 180 students of both Odia and English medium schools were taken as the sample; 90 participants were from either of English or Odia medium schools. After the instructional intervention, it was found out that flipped teaching significantly improved learners' performance. However, the performance of the English medium students was substantially better than Odia/Vernacular medium students.

INTRODUCTION

In order to enhance the 21st-century smart skills among our school children, we need to incorporate independent, active, self-paced as well as collaborative learning strategies in our pedagogical framework. Research studies have established that students' attention declines after 10 minutes in a regular didactic classroom, often fluctuating in between, when learners at the end retain only 20% of the lecture. Hence, as an alternative to this, the "flipped classroom" concept has emerged as a better pedagogical model where more of discussion and collaborative inquiry-based learning (Bergmann & Sams, 2012; Lage, Platt, & Treglia, 2000) have replaced traditional classroom lecture. This is otherwise known as "inverted classroom" which provides preliminary learning materials and allows the students to go through self-paced learning; when they come to class with basic knowledge on the concerned topic and the teacher initiates more active learning through students' engagement in collaborative learning activities. Thus, the allotted classroom times are better spent in more teacher-student interactions, clarification of doubts and constructive discussions.

Therefore, in the Indian context, it becomes imperative to examine its efficacy and verify its pedagogical relevance at school level with vast diversity in languages, cultures, and types of schools, learners' characteristics, teachers' mindset and professional competence. As India is a multi-lingual country, approximately 75% of its population does not speak English who use to send their children to vernacular medium schools. Since flip teaching is an innovative pedagogy, it is being extensively used by the most developed countries. Therefore, it has prompted the present researchers to take up this study and try it out at school level in India. However, at higher education level often the technical teachers in India use this method for better student engagement. Presently some empirical works are going on in IITs and ‘Technical Teachers' training institutes. However, rarely it has been practiced or examined at school level in India.

LITERATURE REVIEW ON FLIPPED TEACHING

In 2006, two teachers from Woodland Park High School in Colorado developed the flipped classroom as a way to help athletes keep up with their classes while traveling for sports activities. Bergmann and Sams (2012) noticed that students attending the rural school were often absent due to extracurricular activities. The flipped classroom was the obvious solution to this problem. Their book, *Flip Your Classroom*, was published in 2012 and caught the eye

of the educators at all levels. Thus began the modern movement of flipping courses at the High school level. Another recently conducted experiment (Davies, Dean, & Ball, 2013; Strayer, 2012) indicates that there is no significant difference in students' performance between flipped classrooms and traditional classrooms. Strayer (2012) reported that students perceived a significantly lower level of structural support during the flipped instruction, warning that this perceived lack of support might lead to lower engagement. In 2011, the social studies teacher of Michigan's Clinton Dale High School flipped every classroom. They taught two classes with identical material and assignments, one flipped and the other one conventional. After 20 weeks, students in the flipped classroom outperformed the students in traditional classrooms and the traditional classroom showed no change. Bhagat, Chang, and Chang (2016) examined the effectiveness of the flipped classroom on learners with different achievement levels in learning mathematics concepts. 82 high-school students participated in this study, divided into experimental and control groups. A significant difference was found out in the learning achievement and motivation between the two groups, with students using the flipped classroom performing better. Further analysis showed a significant difference in the performance of low achievers in the experimental and control groups. Lee and Lai (2017) carried out an exploratory study on applying the "flipped classroom" approach in his information and communication technology (ICT) class. The study examined student perceptions of the new teaching approach and investigated whether it can help promote higher-order thinking. This study involved 28 students in a public secondary school in Hong Kong. They were attending an ICT class on 3D modeling. The findings showed that students were inclined to accept the new teaching model. It can be concluded that it is possible to improve students' higher-order thinking capability using the flipped classroom approach in teaching. Aidinopoulou and Sampson (2017) conducted an action research focusing on the implementation of the FC model in teaching social studies in primary school. The study revealed that indeed, the classroom-based sessions of the experimental group were used for engaging student-centered activities subsequently resulting in better learning outcomes in terms of demonstrating critical HTS. (Rotellar Cain, 2016; Veeramani, Madhugiri, & Chand, 2015) have focused on some limitations of the flipped classroom. According to them, the problem mostly encountered is when the students come to the class unprepared. Similarly few others (Kim, Kim, Khera, & Getman, 2014; Milman, 2012), have observed a lack of motivation among students in the flipped classroom. Students' failure to use the correct study material outside of the class time is another drawback shown by some empirical studies (McLaughlin et al., 2014; Ramar, Hale, & Dankbar, 2015).

RESEARCH GAP

The above review reveals that there is not a single pedagogical design of flipped classroom that has been proved effective so far. Since the ability of the learner differs from person to person, the structure of the classroom also differs from one to the other. So a particular pedagogical model of the flipped classroom effective for one group of students may not fit properly among the other group of students. In India, we come across the schools and colleges that vary in the name of the language of instruction, course curriculum, learner characteristics, infrastructural facilities as well as the quality of the teacher. The review of the literature has not addressed all these school variables in the research on the effectiveness of flipped teaching. The flipped classroom has been proved to be effective in many subjects, starting from arithmetic, science, history to another technical subject like ICT. However, the pedagogical intervention or the flipped teaching method appropriate for each of these subjects has not been explained in clear terms.

RATIONALE

Flipped classroom demands independent learning ability from the students. Among the school students, the effectiveness of flipped teaching is a questionable issue because it needs learning that is more independent and the secondary level school children are too small to be independent and self-learners. Though some researchers have already studied the effectiveness of flipped teaching method on school students and have got the positive result in favor of flipped teaching pedagogy, the differences in social culture, the maturity level of students, infrastructural facilities and peer-group influences in schools have less been analyzed so far. Therefore, the present study intends to measure the flipped teaching impact across the two different mediums (Odia & English) of instruction at Grade 8 level. In the school, students study a range of subjects whereas in higher education the course structure is more specialized. So the pedagogy that helps in case of one subject may not be effective in other subjects. So the present study has tried to compare the effectiveness of flipped mode in teaching science subject at the school level.

RESEARCH QUESTIONS

Based on the research gaps mentioned earlier, the following research questions were drawn:

1. How does the flipped teaching influence the secondary level school students' Performance in Science subject?

2. How does the medium of instruction (English and Odia) influence the students' performance in Science subject at the school level?

3. How do the interactions between modes of instruction and mediums of instruction influence the students' performance at the secondary school level?

4. How do the co-variables of English and Odia medium schools influence the performance of Grade 8 students?

RESEARCH DESIGN

The following Fig.1 describes the conceptual model of the work. There are three variables and each variable has two levels. Medium of instruction and Mode of instruction are two independent variables; Students' performance is a dependent variable. Medium of instruction has two levels, such as Odia and English mediums; Modes of instruction has two levels, like traditional mode and flip mode of instruction. Students' performance was measured before as well as after the instructional intervention; Pre-test and post-test were conducted to measure the performance. Therefore, a 2 × 2 × 2 factorial ANOVA design was applied to analyze the variables.

Conceptual Model

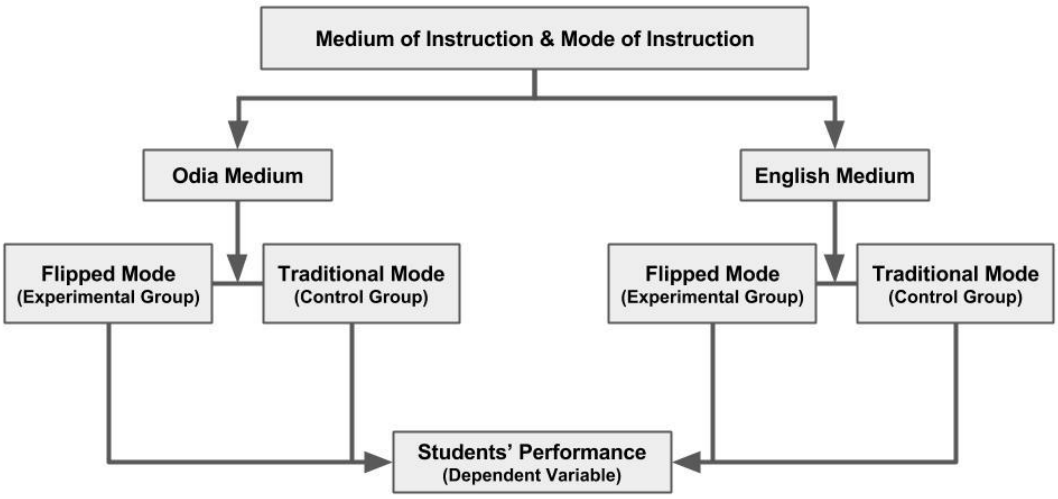

Figure 1. Explains the flow chart of study as well as the variables studied

METHOD OF STUDY

Sample

Samples were collected from two different schools; one is state board school following the State Council of Educational Research and Training (S.C.E.R.T) pattern; the other one is a private school following the C.B.S.E. pattern. In total 180 students were taken as the sample for this study. In total 90 samples were taken from one of the Odia medium schools situated at Bhubaneswar, Odisha, India, (Patrapada Upper Primary school); another 90 samples were taken from the (Bibekananda English medium school) situated at the same city. The purposive sampling method was followed to collect the samples.

Tools

- Both the pre-test and post-test questionnaires were developed in Science subject from class 8 textbook of both the English and Odia medium schools.
- In Science, the topics of "Force and Pressure" & "Friction" were covered.
- Handouts on these topics were prepared and distributed by the teacher.

ETHICAL CONSIDERATION

Before conducting the research, permission was granted from the authorities of all these schools taken together and the students were informed about the privacy of their data related to this research study.

Timeline	Traditional Classroom
Before Class	Students had no information about what to expect from the teacher in the classroom
During Class	Students tried to follow the teacher in the classroom. The teacher taught within the fixed period. During the lecture, some questions were discussed on the concerned topic but the students' participation was limited since they had limited or no preparation on the topic prior to the class.
After Class	Students were provided with the homework to be done out of the After Class classroom. The teacher graded the homework and delivered the feedback to each student in the next class

***Figure 2*. Traditional classroom Structure followed in the study**

Timeline	Flipped Classroom
Before Class	Students were provided with the study materials prior to the class. The teacher instructed the students to come to the class with prior preparation in the concerned topic. They were also provided with the worksheets on some important question on the topic. Since it was made compulsory, the students were bound to come to the class with prior preparation and their queries.
During Class	The teacher answered the queries put by the students. Teacher facilitated the group discussion among students with immediate feedback. The teacher tried to clear the doubt of students. Peer-instruction & hands-on experiences took place in the presence of the teacher.

***Figure 3*. Flipped Classroom Structure followed in the study**

PROCEDURE

The present study followed a pre-post quasi-experimental design to examine and compare the effectiveness of flipped mode of instruction with the traditional mode of instruction in enhancing the performance of Grade-8 school students. Here we have two independent variables such as medium of instruction (Odia and English) and mode of instruction (flipped and traditional) with two levels of each independent variable. So here, we get four independent groups like, Odia medium students with traditional mode of instructional group (O.M.T) and Odia medium students with flipped mode of instructional group (O.M.F) & English medium students with traditional mode of instructional group (E.M.T) and English medium students with flip mode of instructional group (E.M.F). Before the instructional exposure, all the groups were administered a pre-test on the topics concerned to measure the baseline performance of each group and the post-test was administered to measure the difference in the performance between the pre and post-test across the groups after the course was taught. The results obtained from the analysis are given in the following tables and graphs.

RESULT AND INTERPRETATION

The following Table.1 shows the obtained Mean, Standard deviation score and the sample size of each group in the Pre-test as well as in the Post-test in science.

Table 1

	Pre-Test		Post-Test		
Group	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**N**
Odia medium with traditional mode of instruction (O.M.T)	10.31	2.363	20.00	14.535	45
Odia medium with flipped mode of instruction (O.M.F)	10.11	2.604	30.02	7.867	45
English medium with traditional mode of instruction (E.M.T)	10.4	6.500	24.87	15.825	45
English medium with flipped mode of instruction (E.M.F)	9.00	4.503	33.87	9.044	45
Total	9.97	4.329	27.19	13.281	180

Descriptive Data of all four groups

Table 2

Sources of variance	**df**	**F**	**Sig**
Test Mode (Pre &Post-test)	1	356.934	.000
The medium of instruction (Odia &English medium)	1	3.531	.062
Mode of instruction (Traditional &Flip mode)	1	17.828	.000

ANOVA Table of the main effect

The main effect of Medium of instruction shows an insignificant difference between the Odia (vernacular) and English medium students. It means the whole of Odia medium students along with both the mode of instructional groups is not different significantly from their counterpart groups in English medium. The main effect of the mode of instruction shows the significance of the difference between the traditional and flip mode of instruction. This difference is significant at 0.000 levels. It is quite clear from the descriptive table that the whole of the flipped instructional group has scored higher than the whole of traditional instructional group irrespective of their medium of instruction.

The following result in Table.3 shows the medium of instruction (English/Odia) doesn't play a significant role in enhancing students' performance in science; however, the mode of instruction (Flipped/Traditional) plays a significant role in enhancing the performance. It shows the positive impact of flipped mode of instruction while teaching science.

Table 3

Sources of variance	df	F	Sig
Test mode×Medium of instruction	1	7.061	.009
Test mode×Mode of instruction	1	32.124	.000
The medium of instruction×Mode of instruction	1	.303	.583
Test mode×Medium of instruction × Mode of instruction	1	.004	.951

ANOVA Table of interaction effect among variables

Table 4

IMPACT OF FLIPPED TEACHING ON STUDENTS' PERFORMANCE 12

Group		**Pre-Test**		**Post-Test**	
I	**J**	**Mean Difference between groups (I-J)**	**Sig.**	**Mean Difference between groups (I-J)**	**Sig.**
	(O.M.F)	10.311 -10.111= 0.200	.827	20.000-30.022= 10.022	.000*
(O.M.T)	(E.M.T)	10.311 -10.444 = 0.133	.884	20.000-24.867 = 4.867	.062
	(E.M.F)	10.311 -9.000 = 1.311	.152	20.000-33.867 = 13.867	.000*
(O.M.F)	(E.M.T)	10.111-10.444 = 0.333	.715	30.022-24.867 = 5.156	.048*
	(E.M.F)	10.111-9.000 = 1.111	.225	30.022-33.867= 3.844	.140
(E.M.T)	(E.M.F)	10.444-9.000 = 1.444	.115	24.867 -33.867= 9.000	.001*

Post-hoc analysis for group comparison

The above result of Table.4 compares the mean difference score of each group against the other groups both in the pre-test and post-test of science subject. It shows the insignificant difference between the groups in the pre-test. In post-test English medium students with the traditional mode of teaching don't differ significantly from the Odia medium students with the traditional mode of the instructional group. But the other two groups like Odia medium with flip mode of teaching and the English medium students with flip mode of teaching group differ significantly from the Odia medium with the traditional mode of teaching group. It is clear from the above table that the English medium students with flip mode of teaching group have scored higher in the post-test than other three groups. However, the difference between O.M.F. group and E.M.F. group in the post-test is insignificant.

Flipped mode of instructional group outperformed compared to the other instructional groups. Therefore, we can interpret that the flip mode of instruction has helped students in enhancing their performance.

Classroom Observation

Classroom observation schedule was used to measure the differences in teaching-learning condition between the English and Odia medium schools. This schedule was a five-point rating scale consisting of five factors; under each factor, five items were given to be measured. These factors were broadly identified as school infrastructure, pedagogy, the pattern of evaluation, teacher-student interaction and classroom culture.

The Following Fig.4 represents the result obtained in different variables of English medium schools.

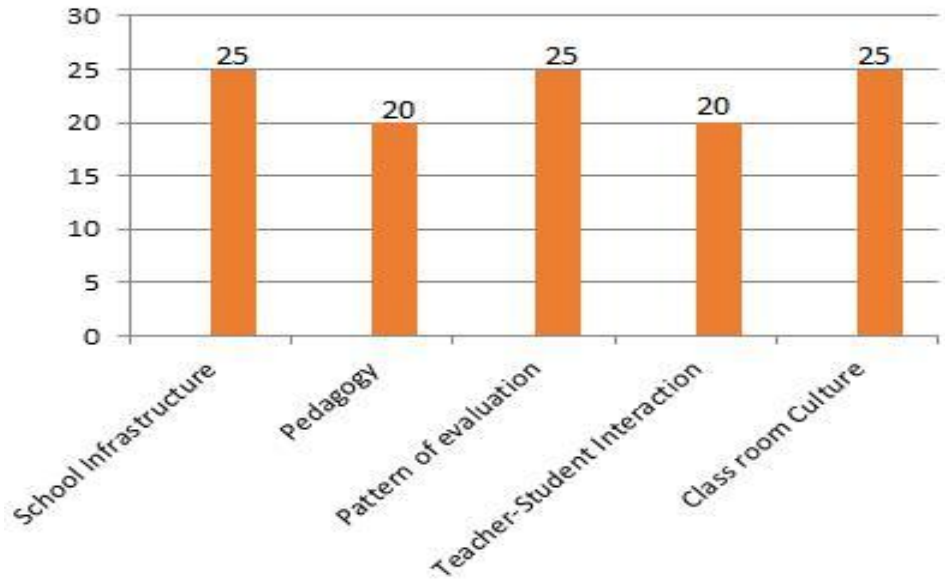

Figure 4. School and classroom condition in English medium School

The Following Fig.5 shows the School and classroom condition in Odia medium Schools

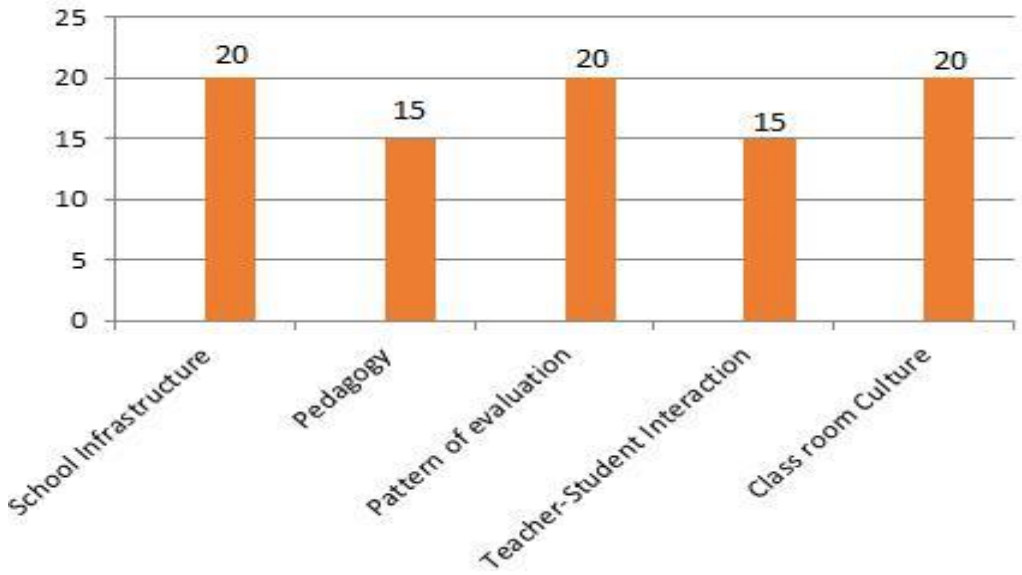

Figure 5. School and classroom condition in Odia medium School

Graphs show (Fig.4, 5) that the English medium school has better facilities for students in case of each category compared to the Odia medium school. Thus, it is quite natural to get the better result from the students of English medium than the Odia medium. But during the post-test, it was observed that Odia medium students with the flipped model of instruction outperformed the English medium students with the traditional mode of teaching. So we can conclude that irrespective of the school condition the flipped model of teaching has helped the students in the process of learning, with a positive impact on their performance.

DISCUSSION AND CONCLUSION

The obtained results showed that the flipped teaching has enhanced students' performance across the mediums of instruction (English and Odia/vernacular); the impact has been substantial. Thus, it addresses the first research question and has found that the main effect of flipped teaching has been positively and significantly improving the learners' performance in science at secondary level of school education.

This has also been supported by other empirical works done in flip teaching at school levels (Bhagat et al., 2016; Elmaadaway, 2017; Lee & Lai, 2017; Sezer, 2017) and also enhances learners' motivation, engagements, improves higher order thinking skill and learning outcomes as well (Aidinopoulou & Sampson, 2017). With regard to the second research question, the medium of instruction was not found to be significantly influencing students'

performance. The interaction effect (third research question) was found to be significant (Table.3). Therefore, both the English and Odia medium school children performed well under flipped teaching context. English medium school students gained more and performed substantially better than Odia/Vernacular medium students perform. However, their performance and motivational level improved significantly compared to traditional/control group of the same medium of instructional group. Moreover, the English medium school teachers are giving more opportunity to their students to appear in national level competitions like Olympiads, workshops and many co-curricular activities for building their confidence and competitive skills. Probably, this has helped these children to quickly adapt to this new pedagogic technique and leverage benefit from this. The Odia/Vernacular medium children are used to didactic lecture method; with more prescriptive, teacher-centered learning environment, thus making the learners more dependent not very apt in self-learning practices. This might be the cause why in spite of improving their performance they could not leverage this technique and outperform English medium students. In this context, we also found some relevant empirical works that focused on the limitations of flipped teaching by stating that problems arise when students came to the class unprepared (Rotellar & Cain, 2016; Veeramani et al., 2015). With lack of motivation in flipped classroom (Kim et al., 2014; Milman, 2012), students fail to use the flipped course material for gaining prior knowledge and actively participating in classroom discussions (McLaughlin et al., 2014; Ramar et al., 2015). Thus, the present researchers assume that some sort of advance organizer prior to actual flipped teaching could be more beneficial and if the teachers regularly practice a method that could give us a better result. Moreover, with regard to the fourth research question, the qualitative data analysis (Graph.4,5) shows that the English medium schools are better than Vernacular/Odia medium State Board schools in terms of infrastructure, pedagogy, evaluation pattern, teacher-student interaction and classroom culture parameters. The English medium school environments are more open, democratic, permissive, student-centered and implement all types of central government initiated innovative schemes, thereby giving more freedom to both teachers and students to try out new things; whereas the State Board vernacular medium schools are more traditional, teacher-centered, less permissive and interactive, thus making the students more teacher–dependent, bookish and examination-oriented. As we have already discussed in the traditional lecture method, the students couldn't hold their attention and concentrate on the topic for the whole period, thus they could take only 20% benefit; due to less classroom interactions and discussions as they are not actively engaged in the learning process and primarily adhering to no self-study and

resorting to memorizing method; learning appears to them as a routine oriented and monotonous task. Therefore, in the present study when the Odia medium children were exposed to a new approach i.e., flipped teaching mode; they became very enthusiastic and performed well. However, in order to leverage this innovative pedagogy and sustain students' motivation, engagement and performance, we have to make it an essential component of classroom instruction, curricula and practice. Thus, the present authors believe that regular practice of innovative pedagogy, along with action research and administrative / leadership support can definitely yield better results; suggest for policy reform, intensive pre-service and in-service teacher education for professional competence, up-to-date syllabus, ICT based infrastructure, regular workshops for community participation, etc.

FUTURE WORK

A longitudinal study with larger sample and other socio-cultural variables i.e., gender difference, socio-economic background has been suggested for wider implications and studies across the levels and school subjects recommended for better engagements and performance appraisals of both the teachers and students.

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