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Effectiveness of Flipped Learning in Developing Higher Order Thinking Skills among Prospective Teachers

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ABSTRACT

The present study was focussing on assessing the effectiveness of flipped learning in developing higher order thinking skills among prospective teachers studying the B.Ed. program. A pre-test post-test control group experimental research design was adopted with a sample of total 64 number of prospective teachers of second semester of B.Ed. course of pre-service teacher education program. Simple random sampling technique was used to form experimental and control group. A test on higher order thinking skills based on a paper of B.Ed. course was developed. The experimental group was taught by following traditional flipped learning approach whereas the control group was taught by lecture method. Before and after the intervention, test was administered to both the groups. The mean difference at post-test between experimental and control group was found to be significant at 0.05 level of significance, thus concluding the study that flipped learning method has a significant effect on developing higher order thinking skills than lecture method. The study calls for teaching community to use flipped learning strategy as an instructional method in teaching and research community to conduct future researches and government bodies to empower the teachers to use the flipped learning method.

Keywords: Flipped learning, Prospective teachers, Higher order thinking skills, B.Ed. course, Pre-service teacher education program.

INTRODUCTION

A vital component of the social and educational systems is teacher education. The adage "teacher builds nation" is well known. "The National Council for Teacher Education has defined teacher education as a programme of education, research, and training of persons to teach from pre-primary to higher education level" (Lal, 2017, pp. 16). Teacher education program offers training to pre-service and in-service teachers, develops the knowledge, attitude, behaviour and professional skill to perform the role in the real classroom, school and society as a whole. In India, teacher education is provided in

face to face, online and distance modes. Teachers are supposed to develop the critical thinking skills necessary to address problems with material, organisation, and teaching strategies. Looking at the rapid innovation in knowledge and technology the 21st century education demands an education system that enables the development of higher order thinking skills. As per the crucial demands of the present time, development of higher order thinking skills among the prospective teachers has gained an urgent attention because then only they can implement it in their real teaching. Pre-service teachers of English subject, perceived the necessity of development of higher order thinking skills (Fakhomah & Utami, 2019, Sajidan, Akhyar, & Suryani, 2018).

As per revised Bloom's taxonomy in 2001, the six different types of cognitive processes were remembering, understanding, applying, analysing, evaluating, and creating. These were scaled into a hierarchical structure like pyramid keeping remembering at the bottom most level then understanding, applying, analysing, evaluating and creating at the top most level. From this pyramid, the top three cognitive processes demand higher order thinking skills. Higher order thinking skill demands thinking that is beyond the reproduction of facts or memorizing information (Fakhomah & Utami, 2019). Thinking does not happen in an isolated manner; thus, higher order thinking skills (HOTS) cannot be developed without lower order thinking (LOTS). (Gupta & Mishra, 1991).

Thus, any strategy that takes care of both the development of HOTS & LOTS can have the potential of developing higher order thinking skills. Such a strategy is flipped learning method where the usual class takes a flip. In flipped learning approach, the in-class activities are done at home before coming to class whereas the homework is done during the class hours. This instructional method was discovered by Bergmann and Sams in 2014 in order to bridge the learning gap of the absentee students. "Flipped learning is defined as a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter" (Definition of Flipped learning, 2014). Students also receive enough time to learn the lower-order thinking skills at their own pace and were prompted to make notes and comments regarding the lesson. To aid in the learning, lower-order thinking skills were reviewed in the classroom. Higher-order thinking skills are practised during in class activities under the instructor's control, such as conversations, critical thinking, pair work, group work, etc., which eventually increase student involvement (Alsowat, 2016).

The modern era envisions education to develop higher order thinking skills among individuals which will help them to deal with real life situations in solving new problems, in analysing a situation, justifying the right over the wrong etc. Thus, studies that explore the means of developing higher order thinking skills are highly on demand. Looking at the potentialities of flipped learning method, the researcher intends to carry out research to explore its impact on developing higher order thinking skills.

RATIONALE OF THE STUDY

Constructivism, the new paradigm of learning believes on creation of knowledge rather than reproducing knowledge which stresses on thinking of an individual not just the function of memory. Thus, the exploration of different instructional methods that will aid the learners in developing thinking skills is quite evolutionary. Flipped learning method is a technology driven instructional method which facilitates student's learning at their own pace, place and time. The below cited research studies will give the reader an overview of the impact of flipped learning on different dimensions of learning.

Informing learning objectives, asking questions to students, using group discussion, giving feedback, and giving motivation were some of the strategies used to in teaching reading skills to promote higher order thinking skills (Indriyana & Kuswandono, 2019). In 2021, Gupta & Mishra highlighted those brainstorming sessions, encourage questioning, emphasizing on project based and activity-based learning are some strategies for developing higher order thinking skills. Alsowat in 2016

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found that the flipped classroom model proved effective in raising students' engagement, satisfaction, and higher order thinking skills in foreign languages. A total of 67 graduate students were used as a sample and a quasi-experimental research design was adopted for carrying out the study. In 2017, Lee & Lai came to the conclusion that the flipped classroom strategy was an effective way to get students to develop higher order thinking skills. The survey found that students had a positive attitude towards the new teaching method and showed improvement in their ability to think critically. The researcher used group discussions and online quizzes to gather qualitative and quantitative data respectively on students' perception and achievements. Ghoneim & Badawy (2018) conducted a quasi-experimental design to investigate how flipped learning affected students' engagement and higher-order thinking skills. A simple random sample of 110 nursing programme students were considered as sample. The results indicated that flipped learning was a successful teaching strategy in improving higher order thinking skills, students' engagement and their level of satisfaction. Pardosi (2021) found that flipped learning method of teaching had a positive impact on Chinese undergraduate students' development of higher order thinking skills (HOTS). The researcher used paired sample t-test, to compare the pre-test and post-test scores of the participants. The results showed that the students who received flipped learning instruction had significantly higher scores on the post-tests than those who received traditional teaching methods. In 2022, Zain, Sailin, and Mahmor found that group-based flipped learning (GBFL) is an effective method for fostering higher order thinking skills among pre service teachers. The rubric was used to evaluate the performance of GBFL addressed higher order thinking skills such as integrating theory into practical teaching and learning practise, comparing and contrasting ideas, and evaluating the validity of different theories. Flipped learning approach has the potential to increase motivation, learning, engagement (Nouri, 2017 and Sahoo & Mohalik, 2023). Irianti et al. in 2022 conducted an experimental study to compare the effectiveness of the flipped classroom model with traditional instruction in promoting higher order thinking skills in listening comprehension classes. The participants were third-semester students at a private university in Indonesia, randomly assigned to experimental and control groups. Pre and post-tests measuring students' listening comprehension skills and higher order thinking skills were used by the researchers to gather data. In order to learn more about how students felt about the flipped classroom concept, surveys were also done. Both descriptive and inferential statistics were used to analyse the data. The study came to the conclusion that using a flipped classroom method can help listening comprehension classes to foster higher order thinking skills. Nouri in 2016 conducted a survey on 240 number of students and found a positive attitude towards flipped classroom method and use of video learning materials and Moodle as a learning management system.

From the above studies, researcher could realize the importance of development of HOTS. Some researches were carried out to analyse the effectiveness of flipped learning method on development of higher order thinking skills among the students of higher education. But all those studies were conducted in foreign context, in various courses like nursing, undergraduate and teacher education program. But the study by Zain et al. in 2022 which was carried out in teacher education program took 17 pre-service teachers as sample which was very small and thus limiting its generalizability. Thus, the researcher planned to analyse the effectiveness of flipped learning method on development of higher order thinking skills among prospective teachers at secondary level taking pre-test post- test control group research design.

Objective of the Study

- To study the effectiveness of flipped learning on development of higher order thinking skills among prospective teachers.

Hypotheses of the Study

- H0: There will be no significant difference between the mean post test score of experimental and control group.

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METHODOLOGY

To fulfil the purpose of the study, researcher adopted the pre-test post-test control group of experimental design. In this study the independent variable was flipped learning method and higher order thinking skills of prospective teachers was the dependent variable. All prospective teachers of B.Ed. program enrolled in Regional Institute of Education (NCERT), Bhubaneswar was considered as the population of the study. Using simple random sampling technique, students were divided into two groups. After removing the absentees in pre-test and post-test a total of 64 students were considered as final sample for analysis. 32 prospective teachers (21 female and 11 male) were there in each experimental and control group.

A test on higher order thinking skills based on the paper of “Assessing Learning” of second semester of BEd. Program, was developed to assess the higher order thinking skills among the prospective teachers. The test consists of total forty number of multiple-choice questions, each having four no. of choices, choosing each correct answer will get one mark and wrong answer will get zero mark with no negative marking. Pilot study was undertaken to establish the reliability and experts’ judgement was considered to establish the validity of the test. The reliability coefficient of the tool was found to be 0.74 which shows a strong reliability coefficient.

Procedure of Experiment: Experimental and control group were designed each having 32 prospective teachers using simple random sampling technique. Both the groups were oriented about the study i.e., the objectives, the procedure of the research. A pre-test was administered to both the groups before the starting of experiment. The Experimental group was taught through flipped learning method whereas the control group was taught through traditional method i.e., lecture method. Separate lesson plans on assessing learning paper were prepared for both the groups. For the control group the lesson plan, instructional method was lecture method. The in-class activities of experimental group were assigned as homework to control group. Google classroom is a unique product in Google workspace for education where instructors and students can communicate easily, announce classes, assign work, and stay organized. All members of experimental group were joined to the google classroom via shared link. Then all instructional materials in the form of PPT, video clips, audio clips and text material were uploaded on that google classroom platform a day before the class. Students were asked to go through the learning material and to make note of it and point out the queries or doubts that may arise. The in-class period started with clearing the doubts or queries of the students followed by group discussions, leaning activities, assignments, presentations as designed per lesson plan. Students were motivated to follow and make themselves involved in those instructed activities. The last 10 minutes of the lesson were devoted in discussing the learning points and giving feedback to students. The study was conducted for a semester. After the completion of intervention, the same test was administered to both the groups as post-test.

DATA ANALYSIS

Data collected through pre-test and post-test were entered in Microsoft excel and analysed through Jamovi 2.3.21 version of statistical open software. Descriptive statistics and inferential statistics were used to analyse the data.

Descriptive Analysis of Pre-test and Post-test of Experimental and Control Group

To have an understanding on the distribution of data, mean, standard deviation and standard error of mean were calculated from the collected data at pre-test and post-test of both the groups.

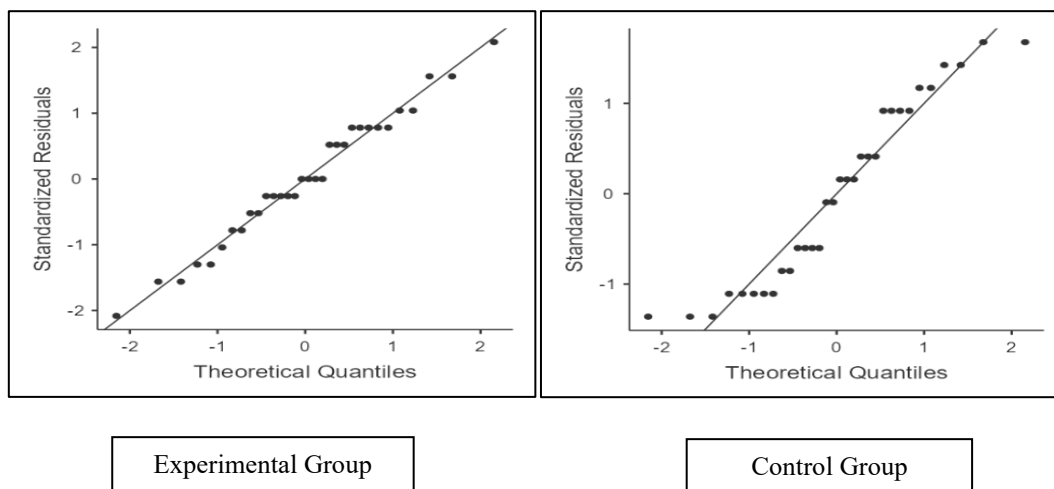
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Table 1: Descriptive measures on pre-test data of experimental and control group

Pre-Test	Experimental Group	Control Group
Statistics	HOTS	HOTS
N	32	32
Minimum	9	12
Maximum	25	24
Mean	17	17.4
Standard Deviation	3.84	3.95
Shapiro Wilk p	0.812	0.02
Standard Error of Mean	0.679	0.698

From the above table on descriptive measures of pretest data of experimental and control group, data shows that total 32 number of participants are in both the groups. The mean score of experimental groups in higher order thinking skills test was 17 and that of control group was 17.4. The minimum score of experimental groups is 9 where as that of control group is 12. The maximum score of experimental groups is 25 and that of control group is 24. The standard deviation of scores in pre-test of experimental group is 3.84 and that of control group is 3.95. This indicates the variance is minimum in the data set of both the groups. The standard error of mean of total scores of experimental groups is 0.679 and that of control group is 0.698 which means the sample mean will resemble to that of population mean. Shapiro Wilk test was carried to check on normality of the data set. The Shapiro Wilk probability value of experimental group came 0.812 and that of control group was 0.698 which means both the data set are normally distributed.



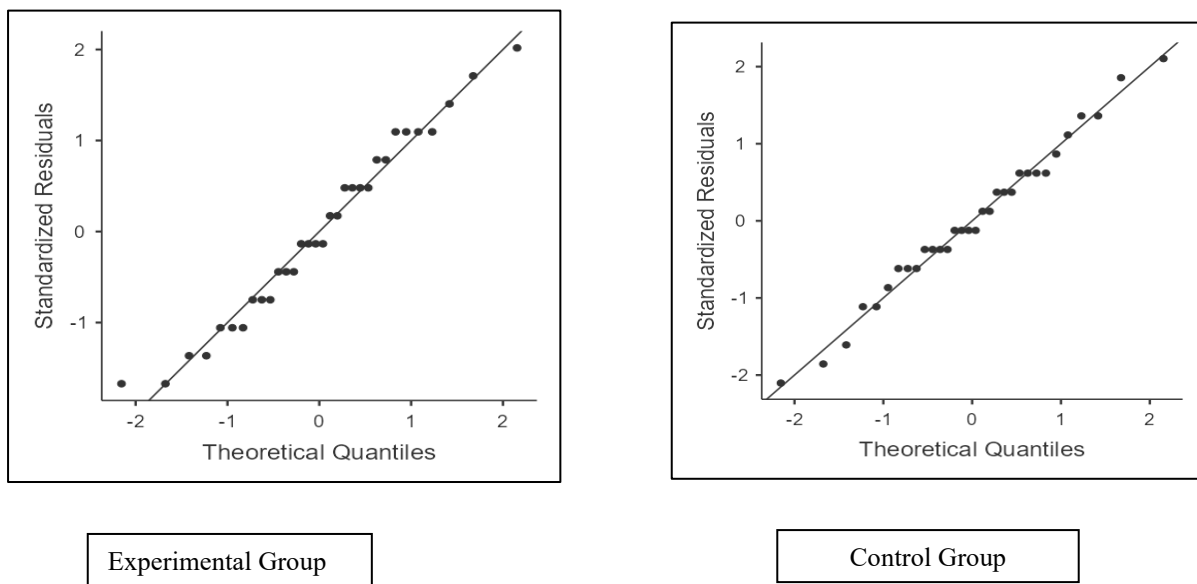
(Fig. 1: Q-Q Plot on pre-test score of experimental & control group)

The Q-Q plot on pre-test score of experimental and control group depicts that both the data set are normally distributed.

Table-2: Descriptive measures on post-test data of experimental and control group

Post-Test	Experimental Group	Control Group
Statistics	HOTS	HOTS
N	32	32
Minimum	18	13
Maximum	30	30
Mean	23.4	21.5
Standard Deviation	3.25	4.04
Shapiro Wilk p	0.534	0.941
Standard Error of Mean	0.575	0.714

From table-2 the data reflects the descriptive measures of both experimental and control group in post-test. The minimum score secured in experimental group was 18 out of 40 and that of control group was 13. The maximum score of experimental and control group was 30. The mean score of experimental groups was 23.4 and that of control group was 21.5. The standard deviation of experimental group was 3.25 and that of control group was 4.04. that is the individual score lies mean \pm 3.25 and mean \pm 4.04 of experimental and control group respectively which depicts a close variance of both the data set. The standard error of mean of experimental and control group was 0.575 and 0.714 respectively which shows the sample mean will resemble the population mean. The Shapiro Wilk probability value came 0.534 and 0.914 which is more than 0.5 again shows the evidence that the data set resembles a normal distribution.



(Fig.2: Q-Q Plot on post test score of experimental & control group)

The Q-Q plot on post test score of experimental and control group depicts that both the data set are normally distributed.

Comparison of pre-test and post-test performance on HOTS between experimental and control group

To analyse whether any significant difference exists between the two groups which has gone through the intervention and which has not, independent sample t-test was used on both the pre-test and post-test data.

Table 3: Independent sample t-test on pre-test of both experimental and control group

Variables	Group	N	Mean	SD	df	t-value	Sig
HOTS	Control	32	17.40	3.95	62	0.385	0.702
	Experimental	32	17.00	3.84			

Table 3, depicts the t-value of both experimental and control group on pre-test score on higher order thinking skills. The reported t value was 0.385 which is not significant at 0.05 level of statistical significance. Thus, it can be concluded that there is no statistical significance between the average performance of experimental and control group that is both the groups are equivalent before starting of the experiment.

Table 4: Independent sample t-test on post-test of both experimental and control group

Variables	Group	N	Mean	SD	df	t-value	Sig
HOTS	Control	32	21.50	4.04	62	-2.51	0.015
	Experimental	32	23.40	3.25			

Table 4, depicts the t-value of both experimental and control group on post-test on higher order thinking skills. The reported t value was -2.51 which is significant at 0.05 level of statistical significance. Thus, it can be concluded that the null hypothesis framed earlier i.e. there is no statistical significance between the mean score of experimental and control group is rejected. Thus, the better performance of experimental group over control group on higher order thinking skills is not due to any chance factor rather because of the differential treatment.

RESULT AND DISCUSSION

The descriptive analysis of the pre-test data showed that the minimum score obtained by the experimental group was 9 and that of control group was 12 whereas the maximum score obtained by the former group was 25 and the later one was 24. The difference between mean score of experimental and control group was 0.40, which is very negligible. From table 3, while comparing the mean performance of both experimental and control groups at pre-test the t-value came 0.389 at df 62, which is not significant at 0.05 level of significance. Thus, from the analysis, it can be concluded that both experimental and control group were equivalent from the perspective of performance in higher order thinking skills before the intervention. From the descriptive analysis of post-test data, the minimum performance of experimental group was 18 and maximum performance was 30 which showed a remarkable progress than the pre-test. The difference between mean performance of experimental group and control group was found to be significant at 0.05 level of significance (t-value at df 62 = -2.51). The Q-Q plots reflected that the pre-test and post-test data were normally distributed that means the findings of the present study is generalizable to the entire population. Thus, it is accepted that the flipped learning method has a significant effect on development of higher order thinking skills among prospective teachers at secondary level. The present study's findings were found to be similar with the study carried out by Irianti et al. in 2022 in establishing the significant effect of flipped learning on

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developing HODS in listening comprehension classes. The findings of the studies carried out by Ghoneim & Badawy in 2018, Pardosi in 2021, Alsowat in 2016 were in congruent with the present study. In 2022, Zain et al. recognized that the flipped learning had effect on developing higher order thinking skills among pre-service teachers' which was very similar to the result of the present study. so here it can be concluded that the result of the present study was in line with the previous studies.

EDUCATIONAL IMPLICATIONS

Teacher education is one of the crucial sections of the educational system where students are prepared to become skilled teachers. Thus, the quality of teacher education program keeps its own relevance and priority. So, the aim of the different teacher education courses designed for pre-primary to secondary level classes was to improve the pedagogical skills of pre-service and in-service teachers. Flipped learning method is one the newly world-wide accepted pedagogical approach which gained positive results in different dimensions like improvement in student engagement, motivation, learning achievement and perception. The present study found that adopting flipped learning method as an instructional method abled to develop higher order thinking skills among prospective teachers. This study calls for the researchers and academicians to carry out further researches to understand the effect of flipped learning on different dimensions of learning. Again, it empowers the teaching community to use flipped learning in their teaching to bring more effectiveness to their teaching. It calls for the higher authority of the institutions to equip the teachers with technological devices and speed internet connections to enable them to apply. The study was also suggested the Government to arrange in service training programs for teachers on use of flipped learning and to provide financial aids to educational institutions to have a supply of ICT equipment so that the students who were not able to do regular classes due various academic or non-academic reasons can make-up their study losses.

CONCLUSION

The flipped classroom provides a wide variety of opportunities for students to explore their learning, knowledge, boost their autonomous learning, foster successful student interaction, and engage them in higher order thinking skills. It offers the instructor with a variety of resources and immediate feedback for the kids. The coverage of content that requires lower order thinking makes in-class time free to the students as well as instructor to utilize in different learning activities to further the learning. The present study was focussed on exploring the effectiveness of flipped learning method on developing higher order thinking skills. Flipped learning was used as an instructional method in teaching a paper in B.Ed. program. The group taught through this method was found to achieve better performance which was statistically significant at 0.05 level of significance. Thus, the study is devoted to enrich the research literature on flipped learning in developing higher order thinking skills among prospective teachers. The present study was delimited with respect to the sample i.e. students of a single institute was taken for the study thus may limits it's generalizability which can be further studied.

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