

Effect of Synchronous and Asynchronous Mode of Online Teaching on Achievement in Environmental Education of Prospective Teachers

Shalini Tiwari, Vikramjit Singh

Department of Education, St. Xavier's College of Education(Autonomous), Patna

ABSTRACT

Technology-supported online learning has become today's popular trend in providing education from school to higher education. Prospective teachers are the stakeholders of the future school education system. Online technology-supported learning skills must be developed among them, and its efficiency in teaching learning has to be investigated. Keeping this idea in mind the present experimental study has been conducted on 80 prospective teachers. Prospective teachers were taught environmental education in two groups, with one group providing a synchronous mode of online learning and the other group participants providing the asynchronous mode of online learning. The results showed no significant differences in the achievement scores of the teachers undergoing learning in any of the modes. Similarly, there was no sex-related differences in the achievement level of students.

Keywords: Online learning, Synchronous mode, Asynchronous mode, Prospective teachers, Environmental education

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INTRODUCTION

Background of the Study

The educational system, spanning from elementary to tertiary levels, has experienced severe challenges due to the recent experience during the novel coronavirus disease 2019 (COVID-19) pandemic, not only in India but globally. During that period, many schools, colleges, and universities transitioned away from face-to-face teaching to online and technology-supported learning within a short period since the onset of the pandemic. It also emerged as a looming concern about the potential loss of academic years, including 2020 and beyond. Consequently, a pressing need to innovate and implement alternative educational systems and assessment strategies was felt and thus, the COVID-19 pandemic presented an opportunity to embrace digital learning.

In today's digital era, many new learning technologies have played a pivotal role in facilitating teaching and learning during the pandemic and beyond ever after. These technologies share a common trait of supporting both asynchronous and synchronous learning in online environments.

Synchronous learning involves interactive, real-time education with a teacher, whether online, offline, or through distance learning. On the other hand, asynchronous learning occurs virtually without the constraint of real-time presence and allows for flexibility in pacing. Synchronous instruction, typically delivered in "chunks" to prevent prolonged screen time, includes methods like video conferencing. Asynchronous learning encompasses various forms, such as recorded lessons, online activities, or offline tasks, designed to be self-paced and flexible to accommodate students' schedules.

Although in our country it has been done recently in the past two decades, the 1990s witnessed the emergence of tele-campus globally, where universities began offering courses and degree programs through a blend of synchronous and asynchronous online instruction. Online teaching and learning, broadly defined as

Corresponding Author: Vikramjit Singh, Department of Education, St. Xavier's College of Education(Autonomous), Patna, e-mail: singhvikramjit@hotmail.com

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utilizing computer and communication technology, has seen rapid growth, particularly in higher education institutions. Asynchronous learning is primarily self-directed and can occur independently or collaboratively through various online platforms.

Future educators play a critical role in shaping the next generation, requiring strong content knowledge and the ability to engage students meaningfully. Teacher education programs have incorporated various curricular aspects, including environmental education, to equip prospective teachers with essential skills. Online teaching and learning exposure has become integral to teacher training, although initial struggles were common among many educators. However, educators have adapted to this pedagogical shift over time and demonstrated proficiency in meeting curriculum expectations through synchronous and asynchronous online experiences.

This study aims to compare the effectiveness of synchronous and asynchronous learning modes in achieving curricular goals, particularly in the area of environmental education, among prospective teachers.

REVIEW OF RELATED LITERATURE AND SIGNIFICANCE OF THE STUDY

Several studies have explored the effectiveness of synchronous

and asynchronous e-learning modes on students' academic performance. Dada and Alkali (2019) conducted research involving 1000 students and teachers, using a questionnaire to collect data. Their findings indicated that students' attitudes toward these modes significantly influenced their academic outcomes, with 55% of the sample demonstrating an understanding of the concepts and recognizing positive impacts on performance. Additionally, Farros, Shawler, Gatzunis & Weiss examined the effect of synchronous discussion sessions within an asynchronous online course, finding limited evidence that either mode significantly impacted student performance. Lin & Gao's study focused on the sense of community and perspectives of students enrolled in synchronous and asynchronous online courses in China, with a majority favoring asynchronous learning. Lastly, Li, Finley, Pitts & Guo explored student-faculty interaction, concluding that providing an email-turnaround-time guarantee led to higher satisfaction levels among students. These studies collectively highlight the nuanced impacts of synchronous and asynchronous e-learning modes on students' academic experiences.

Multiple studies in India have investigated the effectiveness of synchronous and asynchronous e-learning resources at the higher education level. Malik, Fatima, Hussain & Sarwar (2017) discovered significant variations in student responses regarding the efficacy of these modes, with students showing a stronger preference for synchronous activities, particularly when grades were at stake. Similarly, Shahabadi and Uplane (2015) explored the learning styles of e-learners in both synchronous and asynchronous environments, along with their academic performance. Their research, conducted among 731 e-learners from six virtual universities in Tehran, revealed distinct preferences in learning styles across performance groups, with synchronous learners favoring assimilating and diverging styles and asynchronous learners favoring assimilating and converging styles. These findings shed light on the intricate relationship between e-learning modes, learning styles, and academic outcomes among higher education students.

Recent experience due to the pandemic has dramatically influenced every sector of society. The Field of education, from early school till higher education, has also been affected a lot. The covid-19 crisis has forced education systems worldwide to find alternatives of face-to-face instruction. As a result, teachers and students have used online teaching and learning on an unprecedented scale since lockdown.

With the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms, there has been an entire shift in teaching teaching-learning paradigm to a techno-pedagogical approach. During the lockdown period and now post-pandemic, we can see that we have become too much dependent on online education either asynchronous or in synchronous form. Research suggests that online learning has been shown to increase retention of information and take less time.

These two modes of online teaching and learning possess different strengths for the learners. We must know which medium is more beneficial and, which group of learners and on which type of performance. Thus, this study has been conceptualized to assess the effectiveness of these two different forms of online teaching mode. Bihar, specifically Patna has lots to do while using technology to its full potential for the benefit of higher education learners. Thus, The present study will serve as a benchmark in this direction for the stakeholders to make and implement policy decisions on the use of technology in teaching and learning.

Statement of the Problem

Synchronous and Asynchronous form of online teaching has

different kinds of effects on students learning. The study has tried to investigate the effect of these two (Synchronous and Asynchronous form) mediums of online teaching on the achievement in environmental education of prospective teachers. The study thus is tilted as-

Objectives

- To compare the achievement in environmental education of prospective teachers learning through synchronous mode and asynchronous mode of online teaching.
- To compare the achievement in environmental education of male prospective teachers with the female prospective teachers learning through the synchronous mode of online teaching.
- To compare the achievement in environmental education of male prospective teachers with the female prospective teachers learning through asynchronous mode of online teaching.

METHODOLOGY

The experimental method was used for the present investigation. The specific design used here is a static group comparison design (Table 1). The targeted population was prospective teachers enrolled in B.Ed program in the teacher education institutions of Patna. The sample consisted of 80 B.Ed students those are having environmental education as a paper to study in their curriculum. The students were randomly assigned to two groups (Synchronous Learning Group and Asynchronous Learning Group) for their learning through online mode in both the synchronous and asynchronous mode. In the present study, synchronous mode means the teaching conducted online by the teacher using Zoom or Meet Apps where the teacher and the learner has to be present in real-time. Also Asynchronous mode means all the support provided by the teacher in terms of text files, videos, PowerPoints, Lecture Notes etc. to the learners for their learning in their self-paced mode. The students in the Synchronous mode and Asynchronous mode group were taught selected topics in environmental education using customized lesson plans. After the two-week treatment period, the groups were tested on their achievement test in environmental education paper. Further hypotheses were tested to provide the answers to the study objectives.

TESTING OF HYPOTHESIS AND RESULTS

In the light of the study objectives the framed hypotheses has been tested as below.

$H_{0,0-1}$: There is no significant difference in the mean scores of achievement test in environmental education between the prospective teachers learning through synchronous mode and asynchronous mode of online teaching.

To test the above hypothesis t-test technique has been used and the results are as summarised as below in Table 2.

As observed from the table, the obtained t-ratio value is 0.6885 and the *p-value* is 0.4932 which reveals that the obtained difference is not significant. Hence the framed null hypothesis is accepted and we can clearly say that the two groups have similar performance. Thus, online learning using synchronous mode or provided using asynchronous mode leads to similar results in the prospective teacher's performance. This performance can be also shown in Figure 1A.

$H_{0,0-2}$: There is no significant difference in the mean scores of achievement test in environmental education between the male prospective teachers and female prospective teachers learning through synchronous mode.



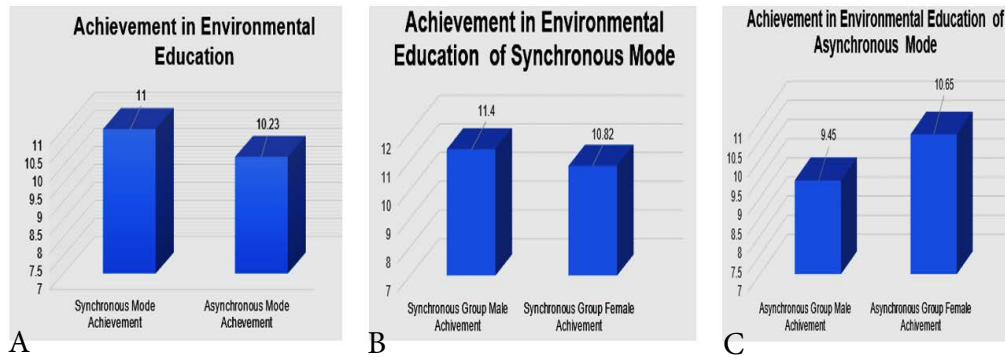


Figure 1: Graphical representation of the findings

Table 1: Process of experimentation can be understood as in the following table

Groups	Treatment of two weeks	Tests	Comparison
Group-1 (G1)	Learning EE through Synchronous mode of online teaching	Post-test (PT) on Environmental Education (EE)	PT _{G1} – PT _{G2}
Group-2 (G2)	Learning EE through asynchronous mode of online teaching	Post-test (PT) on Environmental Education (EE)	

Table 2: T-test analysis results on the synchronous and asynchronous group learners

Groups	Mean	SD	N	t' - value	p-value	Remarks
Synchronous group	11	5.39	40	0.6885	0.4932	Not Significant
Asynchronous group	10.23	4.58	40			

To observe the difference in the performance in environmental education paper among the male and female prospective teachers learning the lessons using synchronous method of online classes, mean group differences has been analyzed using t-test method. The results have been summarised in Table 3.

Observation of the above table shows that the t-test value is 0.3423 and the P-value is 0.7340. These obtained data thus reveal that the obtained value of 't' for 38 degrees is not high enough to be treated as significant. Thus we can say that we failed to reject the framed hypothesis and there is no difference in the learning achievement in environmental education between the prospective male teachers and prospective female teachers learning through synchronous mode. The findings can be seen in Figure 1B.

H_{0,0-3} : There is no significant difference in the mean scores of achievement test in environmental education between the male prospective teachers and female prospective teachers learning through asynchronous mode.

To observe the difference in the performance in environmental education paper among the male and female prospective teachers learning the lessons using asynchronous method of online classes, mean group differences has been analyzed using t-test method. The results have been summarised in Table 4.

The above Table 4 presents the t-test result on the learning

Table 3: T-test analysis results on the synchronous group of male and female prospective teachers

Groups	Mean	SD	N	t' - value	p-value	Remarks
Synchronous group male	11.40	4.83	20	0.3423	0.7340	Not Significant
Synchronous group female	10.82	5.84	20			

Table 4: T-test analysis results on the asynchronous group male and female prospective teachers

Groups	Mean	SD	N	t' - value	p-value	Remarks
Asynchronous group male	9.45	5.57	20	0.7806	0.4399	Not Significant
Asynchronous group female	10.65	4.03	20			

achievement in environmental education of prospective male and female teachers learning through asynchronous mode of learning. The obtained 't' value (0.7806) and the p-value (0.4399) suggest that the figures are insignificant. Hence we can say that there is no significant difference in the mean scores of achievement test in environmental education between the male prospective teachers and female prospective teachers learning through asynchronous mode. Figure 1C also represents the findings graphically.

DISCUSSION AND CONCLUSION

This research paper investigated the effectiveness of synchronous and asynchronous modes of online learning in environmental education among prospective teachers. These findings highlight the importance of considering different instructional modalities to accommodate diverse learner preferences and needs in online environmental education. The findings suggest that both modes, synchronous and asynchronous, yielded similar effects on the participants' learning outcomes. This indicates that educators have flexibility in choosing between these modes based on factors such as the availability of resources, technological infrastructure, and learner preferences without compromising learning effectiveness.

Furthermore, the study found no significant gender-related differences in learning achievement between male and female participants. This suggests that online learning modes can be equally beneficial for both genders, providing an inclusive and

accessible learning environment for all prospective teachers.

These findings contribute to the growing body of literature on online learning effectiveness and underscore the importance of considering various instructional modalities to cater to diverse learner needs in environmental education.

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