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St. Ann's College of Education

(Autonomous)

(Accredited by NAAC with 'A' Grade 4th Cycle)

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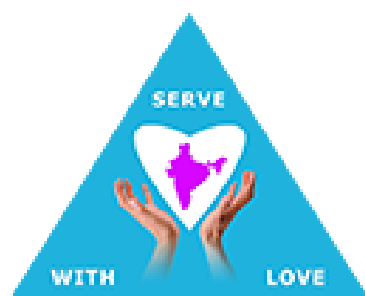
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ST. ANN'S COLLEGE OF EDUCATION (AUTONOMOUS)

S. D. ROAD, SECUNDERABAD

ACCREDITED BY NAAC WITH 'A' GRADE (4th CYCLE)

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Preface

It gives us immense pleasure to present this issue of our academic journal, which brings together a rich and diverse collection of articles that reflect current trends, innovative practices, and critical reflections in the field of education. The research contributions included exploring contemporary educational concerns through empirical inquiry, conceptual analysis, and pedagogical innovation, offering meaningful insights for educators, policy makers, and researchers alike.

The article titled *"A Comparative Study on the Academic Achievement of Students through Online and Offline Modes of Learning"* critically examines how instructional modality affects student outcomes. In the post-pandemic educational landscape, such investigations are not only timely but crucial for designing inclusive and effective learning environments.

"Integrating Arts in Teacher Education" explores the transformative role of art-based pedagogies in enriching teacher preparation programs. By advocating for creative and interdisciplinary approaches, this paper emphasizes the need to nurture aesthetic sensibilities and innovative thinking in future educators.

"Enhancing Listening Skills of Pre-service Teachers using ELT laboratory" examines the level of awareness about communication skills among pre-service teachers and investigated whether the exposure to ELT laboratory environment has any influence on the pre-service teachers' listening skills. This is so crucial as improvements in listening competencies could lead to enhancements in academic achievement and future careers.

With the growing significance of data-informed teaching, *"A Framework of Learning Analytics to Reshape Learning in St. Ann's College of Education"* presents a strategic model for leveraging learning analytics to enhance curriculum delivery and student engagement. This framework offers a forward-looking approach to institutional development and academic excellence.

"Developing Pre-service Teachers' Content Knowledge and Pedagogical Vision for Teaching Social Sciences through Lesson Research" provides a nuanced exploration of lesson study as a professional development tool. It highlights how collaborative inquiry can bridge the gap between theoretical knowledge and classroom application.

The early years of education are foundational to a child's cognitive and emotional growth. *"Effect of Play Way Instructional Strategy on Achievement in Number Work among Preschool Students"* underscores the significance of playful learning methodologies in enhancing numeracy skills among young learners, thereby supporting holistic child development.

In *"Art and Public Policy"*, the intersection of creativity and governance is critically analyzed, reflecting on how artistic expression can shape, critique, and influence public discourse and decision-making. The paper invites readers to consider the broader cultural and social impact of integrating arts into policy frameworks.

Libraries remain vital to the academic ecosystem, and *"An Assessment of Library Facilities and Information Resources in Higher Education Institutions: A Teacher's Perspective"* offers an evaluative lens on their adequacy, accessibility, and alignment with contemporary educational needs, particularly from the viewpoint of teaching professionals.

Finally, *"Mathematisation and Mathematical Intelligence: Two Pillars of Meaningful Mathematics Learning"* delves into the cognitive and conceptual dimensions of mathematics education. By foregrounding the processes of abstraction, reasoning, and problem-solving, the paper lays a strong foundation for reimagining mathematics instruction as a dynamic and meaningful experience.

Together, these contributions embody a commitment to educational inquiry that is rigorous, reflective, and responsive to the evolving needs of learners and educators. We trust that the readers will find this volume thought-provoking and inspiring, and we hope it will serve as a catalyst for further research, innovation, and dialogue in the field of education.

Thank you,

Warm regards,

Chief Editor

Prof. Dr. Sr. Mary Kutty.P.J.

December, 2025

CONTENT

S. No.	Title	Pg. No.
1.	A Comparative Study on the Academic Achievement of Students through Online and Offline Modes of Learning <i>Prof.Dr.Sr.Marry Kutty P.J., Haleema Khatoon</i>	1-18
2.	A Framework of Learning Analytics to Reshape Learning in St. Ann's College of Education – <i>Dr.Ruma Roy, Ms.Irene Catherine Pereira</i> <i>Dr. Sr. Anthonamma N</i>	19-31
3.	Enhancing Listening Skills of Preservice teachers using ELT laboratory <i>Dr.K.Veena Latha, Ms.V.Vishnupriya</i>	32-43
4.	Effect of Play way Instructional strategy on Achievement in Number work among Preschool Students – <i>Dr.Sarah Thomas, Hajiya Mariam</i>	44-64
5.	Integrating Arts in Teacher Education <i>Dr.T.Diana Jacob, Ms.Irene Catherine Pereira, Ms.Ajab Rangoonwala</i>	65-77
6.	Developing Pre-service teachers' Content knowledge and Pedagogical Vision for teaching Social Sciences through Lesson Research – <i>Dr.Mehaboobjan I.A, Dr. Sr. Anthonamma N</i>	78-88
7.	Art and Public Policy – <i>Dr.Lilly Chacko</i>	89-97
8.	An Assessment of Library Facilities and Information Resources in Higher Education Institutions: A Teacher's Perspective – <i>Dr.Tarannum Irshad, Ms.Yasmeen Fantesar, Dr. Sr. Anthonamma N</i>	98-113
9.	Mathematisation and Mathematical intelligence: Two Pillars of Meaningful Mathematics Learning - <i>Mrs.S.Vagdevi</i>	114-124

A Comparative Study on the Academic Achievement of Students through Online and Offline Modes of Learning

Ms. Haleema Khatoon^{1a} and Prof. Dr. Sr. Marry Kutty P.J.^b

ABSTRACT

Due to the Corona Virus (COVID-19) pandemic, many sectors were affected, especially in the education sector. Institutions were forced to adopt distance learning techniques and in many parts of the world, online learning was implemented. Many instructors questioned whether online learning mode was as effective as the offline mode. In this study, the focus was to see whether there was a significant difference in students' achievement between online and offline modes of learning. A total of 40, IXth Grade students, 20 from government school, (Telangana Social Welfare Residential Centre of Excellence, Hyderabad), from which 10 boys and 10 girls who had attended both online and offline classes, and 20 private school students, (Robert Peter High School, Hyderabad), from which 10 boys and 10 girls who had attended both online and offline classes were considered as the Sample of the study. Marks of Formative Assessment - I (FA - I) was considered to compare the online mode of learning and the marks of Formative Assessment - II (FA - II) to compare the offline mode of learning. The data was analyzed using mean, standard deviation and an independent sample t-test. The results showed that there wasn't a significant difference in students' achievement when they opted online or offline mode of learning. Both modes were found to be equally effective in enhancing student understanding and comprehension of the topics. Moreover, it was felt that using a mixture of the two modes, blended learning mode was the best way to maximize the students' academic achievement.

Keywords: *Online mode of learning, offline mode of learning, academic achievement.*

Introduction

Due to the pandemic situation globally, all schools, colleges and universities' academics were shifted to online mode by their respective governments. No one had the information that how long this pandemic would remain, and hence the teaching method was shifted to online mode. Even though some of the educators were not tech-savvy, they updated themselves to battle the unexpected circumstance. Due to this transformation, the role of educational stakeholders had also transformed. The role of teacher is very important in online education than in offline learning.

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Apart from teaching, they also had the responsibility to take care of the mental, physical and emotional wellbeing of students. As the teacher is the first-level counsellor, his/her care and affection will have a great impact on the students. The teacher had to convince the students to use internet responsibly and how its misuse could cause immense damage to one's academic, social and mental wellbeing. As the teacher is closer to the students, many of them may ask various queries relating to examination dates, conduct of examination, methods of evaluation, declaration of results, etc. A negative answer would result in an increase of stress among the students. Apart from the material, the teacher must take care of the duration of the class, timing, sharing of material and the lesson plan, cyber safety and privacy matters. All this information is to be intimated to the students well in advance to mentally prepare them for the class. The teacher should keep in mind the simple rules of slide preparation that it is easily readable and viewable in TV, PC, tablet or mobile phone, 30 to 45 minutes session and use of infographics, graphs, charts, etc. Above all, the teachers must maintain the human touch which makes the class lively and interesting.

The institution's Head also plays an important role in planning and controlling the online classes of the institution. He/she is the manager behind the success of the online classes. Proper planning, coordination and time-to-time evaluation with the teachers, parents or guardian regarding the progress of the courses are vital. Periodic reviews of the progress and communication of the same among the teachers, parents and students make everyone attentive in discharging his/her responsibility prudently.

Significance of the Study

The present study offers a significant contribution to education system by examining the differences in the academic achievement of students through online and offline modes of learning. This study is one of the pioneer research studies investigating the differences in the academic achievement of students among boys and girls of government and private schools. The results of this study will have numerous significant practical implications for educational stakeholders, such as schools, educators, parents, students and researchers to make it more interactive and interesting.

Research Questions

The research questions of the present study are as follows:

- Is there a difference in the academic achievement of students with respect to online and offline modes of learning?
- Does gender influence the academic achievement of students through online modes of learning?
- Does the academic achievement of students differ through online modes of learning with respect to types of school management?

Objectives of the Study

The objectives of the present study are stated as follows:

- To examine whether the academic achievement of students differs through online and offline modes of learning.
- To find out the difference in the academic achievement of boys and girls through online mode of learning.
- To study the difference in the academic achievement of students of government and private schools through online mode of learning.

Hypotheses of the Study

The hypotheses of the present study are stated as follows:

H₁. There is a significant difference in the academic achievement of students between the online and offline modes of learning.

H₂. There is a significant difference in the academic achievement of boys and girls through online mode of learning.

H₃. There is a significant difference in the academic achievement of students of government and private schools through online mode of learning.

Statement of the Problem

A Comparative Study on the Academic Achievement of Students through Online and Offline Modes of Learning.

Operational Definitions of the Study

Academic Achievement: Academic achievement represents the performance outcomes that indicate the extent to which a student or institution has achieved either short or long term educational goals. Achievement may be measured through students' Grade Point Average, examinations or continuous assessments whereas for institutions, achievement may be measured through graduation rates.

Online Learning: Online learning refers to a non-traditional type of learning where learners or students learn in a fully virtual learning environment that is delivered electronically through various multimedia and internet platforms and applications, wherein there is a distance between an educational institution, teachers and students.

Offline Learning: Offline learning refers to a traditional type of learning where learners or students learn in a fully face-to-face with a hands-on learning environment that is delivered within the boundaries of a real classroom, wherein there is a face-to-face interaction between a teacher and a student.

Review of Related Literature

Allen, M., Bourhis, J., Burrell, N., & Mabry, E. (2002), in their study state that the replacement of offline learning will cause a slight reduction in student satisfaction due to different preferences in choosing a learning method. However, they stated that students find distance-learning just as satisfactory as offline learning generally and this doesn't cause any attitude drops.

Bartley, Sharon, and Jennifer (2004), in their article on the evaluation of the cost-effectiveness of online and offline learning provide a relatively concise and precise tabulation of the costs of online and traditional instructions by looking at the history and changes in the education sector. They argue that the potential opportunities offered by online studies include time and travel costs conservation as it does not require travelling as students can attend the classes regardless of geographical location. This timelessness, scalability, and convenience have made online education popular globally.

Brown and Liedholm (2002), demonstrated in their study that the outcomes of their GPA and ACT were somewhat better for the students in an online method than the offline method. A student investigation compared the outcomes discovered in microeconomics. This gap was more pronounced on hard problems and less significant on basic problems. One reason was

that half of the online students reported having spent less than three hours a week and none reported having spent more than seven hours a week. At least three hours a week, half of the students have finished each subject. In another analysis, time gaps for class or active participation showed different result when it was observed (Hiltz, Turoff, 2000). Brown and Liedholm (2002) have found that the performance of women in the standard format was considerably lower than the percentage of men, with six percentage points worse than those performed by male students.

Dabbagh, Nada and Brenda (2005), state that interaction in online learning is between: learners and other learners, instructor, and learners and the instructors and learners and the technology being used. This interaction is very important in online learning to achieve similar results as offline learning.

Dhawan (2020), in his article on online learning, terming it as a panacea in the time of the COVID-19 crisis, states how a pandemic forced education system globally to embrace online learning while some still stuck with the offline system. Shivangi Dhawan (2020), stated the outburst of Ed-tech start-ups to promote online learning and integrate multimedia in education. He argues that despite this boom of online learning, human touch and student-teacher communication is lost with very many technical difficulties as well as lack of motivation from the students posing a serious threat to online education compared to offline studies. However, he states that the outburst of Ed-Tech start-ups is an opportunity to develop online learning and solve most of these problems with better innovations and research conducted on a daily basis making learning comfortable, effective, and interactive for both students and instructors. Natural disasters such as the pandemic have made education systems more resilient and promoted online learning as more institutions are moving from offline classes to flipped classrooms.

Gopal, R., Singh, V. & Aggarwal (2021), pointed out comparing the current research with past studies. The past studies have examined the factors affecting the students' satisfaction in the conventional schooling framework. However, the present study was conducted during India's lockdown period to identify the prominent factors that derive the students' satisfaction with online classes. The study also explored the direct linkage between students' satisfaction and their performance. The present study's findings indicated that instructor's quality is the most prominent factor that affects the students' satisfaction during online classes. This means that the instructors need to be very efficient during the lectures. He needs to understand

students' psychology to deliver the course content prominently. If the teacher can deliver the course content properly, it affects the students' satisfaction and performance. The teachers' perspective is critical because their enthusiasm leads to a better online learning process quality.

Heiman, Heather L., et al, (2012), concluded that online mode of instruction, together with deliberate practice greatly improved the students' oral presentation skills.

Singh, Shweta, David H. Rylander, and Tina C. Mims (2012), stated in their article on the efficiency of online versus offline learning, investigated the efficiency of learners who took part in online studies and compared it to students who took part in offline studies. They found that online learning was more effective than offline learning. They found the mean for online learning to be at 78 while the average for offline studies was at 70. They also concluded that students were more satisfied with online classes compared to offline classes. While only 38% of students in offline classes reported being satisfied with the mode of instruction, 56% of students in the online group reported being satisfied with their mode of instruction. The data in this study was collected from a total of 70 students, 26 students enrolled in the offline system while 44 students were used for the online system.

Palvia, Shailendra, et al, (2018), in their article on worldwide status, challenges, trends, and implications, stated that online education has been growing in popularity globally as a result of the integration of technology in the labour market and the intensified use of the internet in social and economic growth. They incorporated data from different parts of the globe in relation to the adoption of online learning and they concluded that more research was needed to determine the most effective mode of online instruction. They however suggested the continued use of the blended instruction method, commonly referred to as flipped education, to strike an optimal balance between e-learning and traditional learning. This is consistent with the study done by **Callaway (2012)**, where he argued that the right mix between online and traditional modes of instruction is essential for addressing the disparity between convenient and high- quality education between the two instructional methods. They argued that a flipped learning method would be able to solve the problem of social media addiction and provide a healthy lifestyle for learners. He also suggested that online education should be studied by more researchers and given the same importance and attention as the traditional system of education.

Parkes, Stein and Reading (2015), examined how equipped higher education institutions adopt e-learning and state that, while students are ready to cope with technologies employed in

online schools, they are not as ready as they appear to be. The students did not have enough knowledge to think critically in managing the skills of technologies used during online learning including organizing methods, accuracy and concise response and summarization of thoughts.

Variables of the Study

In the present study the independent and dependent variables are stated as follows:

Independent Variables

- Modes of learning: Online and offline
- Gender: Boys and Girls
- Types of school management: Government and Private

Dependent Variable

- Academic achievement of students

Research Design

The present study follows a **descriptive survey design**.

Population and Sample

Population of the study comprises of Adolescent children. In the present study the sample is selected using random sampling technique, which comprises of 40 students of IXth Grade which includes 20 government school students, (Telangana Social Welfare Residential Centre of Excellence, Telangana), from which 10 are boys and 10 are girls who have attended both online and offline classes, and 20 private school students, (Robert Peter High School, Hyderabad), from which 10 are boys and 10 are girls who has attended both online and offline classes.

Research Tools used

As the present study intends to compare the online and offline modes of learning and its effect on the academic achievement of students, in order to test the hypotheses, answer the research questions and achieve the objectives of the present study, the progress cards and scholastic marks sheet of IXth Grade students of both the government and private school was collected to compare the online and offline modes of learning and its effect on the academic achievement of students. Marks of Formative Assessment - I (FA - I) was considered to compare the online mode of learning and the marks of Formative Assessment - II (FA - II) was considered to compare the offline mode of learning.

Statistical Techniques used in the study

- Mean
- Standard Deviation
- Independent sample t-test

Hypothesis – 1

H₁: Research Hypothesis: There is a significant difference in the academic achievement of students between the online and offline modes of learning.

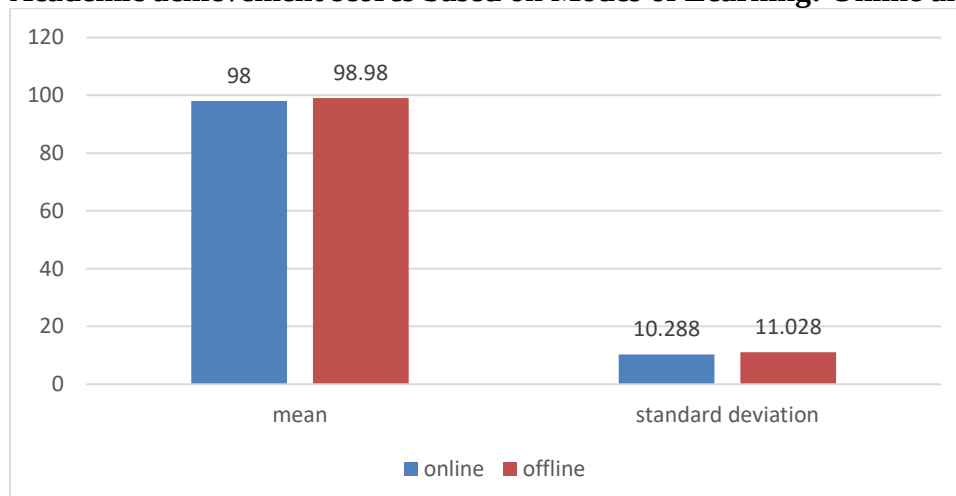
Table 1 Showing Difference in Mean, Standard Deviation and t-value in the academic achievement between Online and Offline Modes of Learning.

Modes of Learning	N	Mean (M)	Standard Deviation (SD)	t value	significance level
Online	20	98.00	10.288	0.409	not significant at 0.05 level
Offline	20	98.98	11.028		

df= 38, t table value= 1.684

Graph 1 Showing Difference in Mean and Standard Deviation scores in the academic achievement between Online and Offline Modes of Learning

Academic achievement scores based on Modes of Learning: Online and Offline.



Interpretation

From Table. 1, it can be observed that the mean Academic achievement scores of the online mode of learning is 98.00 and the standard deviation value is 10.288. The mean value of offline mode of learning is 98.98 and the standard deviation value is 11.028. The obtained t-value 0.409 is less than the standard table t-value 1.684 at df (38) at 0.05 level of significance. Since the obtained t-value is less than the standard table t-value, the null hypothesis – “There is no significant difference in the Academic achievement between the online and offline modes of learning” is accepted and the research hypothesis “There is a significant difference in the Academic achievement between the online and offline modes of learning” is rejected.

Hypothesis – 2

H₁: Research Hypothesis: There is a significant difference in the academic achievement of boys and girls through online mode of learning.

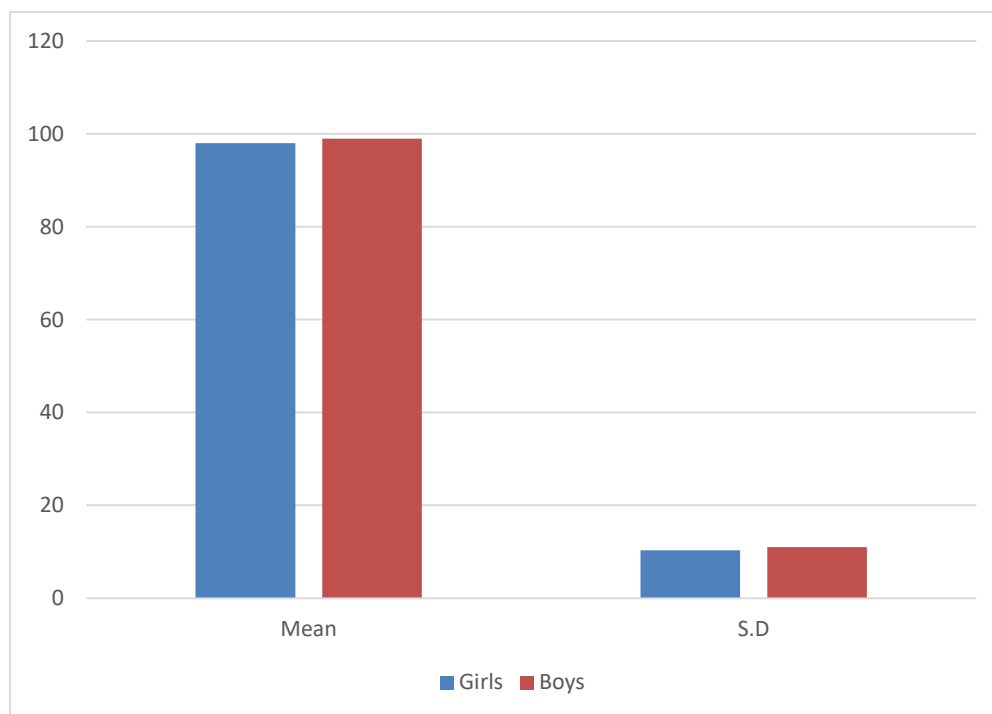
Table. 2 Showing Difference in Mean, Standard Deviation and t-value in the Academic Achievement of Boys and Girls through Online Mode of Learning.

Gender	N	Mean (M)	Standard Deviation (SD)	t value	significance level
Girls	20	98.00	10.288	0.409	not significant at 0.05 level
Boys	20	98.98	11.028		

df= 38, t table value= 1.684

Graph 2 Showing Difference in Mean and Standard Deviation of the Academic Achievement of Boys and Girls through Online Mode of Learning.

Academic achievement scores based on Gender



Interpretation

From Table 2 it can be observed that the mean value of boys is 98.98 and the standard deviation value is 11.028. The mean value of girls is 98.00 and the standard deviation value is 10.288. The obtained t-value 0.409 is less than the standard table t-value is 1.684 at df (38) at 0.05 level of significance., therefore, the null hypothesis – “There is no significant difference in the academic achievement of boys and girls through online mode of learning” is accepted and the research hypothesis – “There is a significant difference in the academic achievement of boys and girls through online mode of learning” is rejected.

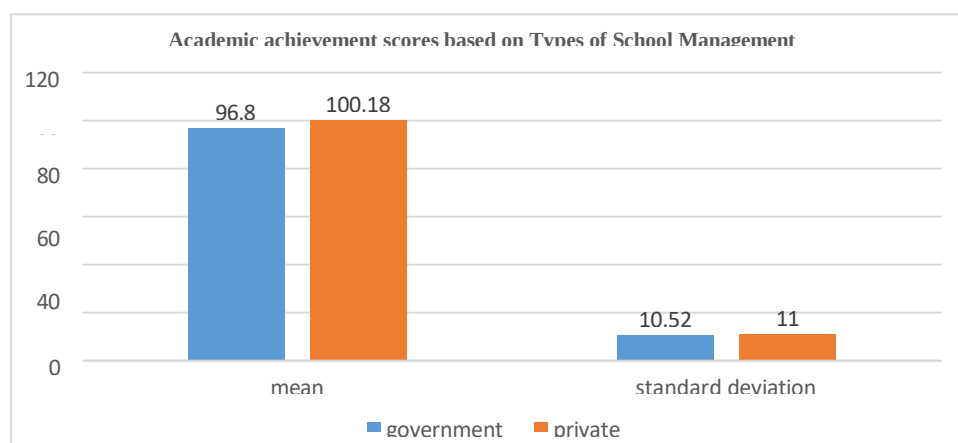
Hypothesis – 3

H₁: Research Hypothesis: There is a significant difference in the academic achievement of students of government and private schools in online modes of learning.

Table 3 Showing Difference in Mean, Standard Deviation and *t*-value in the Academic Achievement of Students of Government and Private Schools in Online Mode of Learning

Types of Management	N	Mean(M)	Standard Deviation (SD)	t-value	significance level
Government	20	96.80	10.525	1.432	not significant at 0.05 level
Private	20	100.18	10.551		
				df= 38, t table value= 1.684	

Graph 3 Showing Difference in Mean and Standard Deviation of the Academic Achievement of Students of Government and Private Schools in Online Mode of Learning.



Interpretation

From Table 3 it can be observed that the mean value of government schools is 96.80 and the standard deviation value is 10.525. The mean value of private schools is 100.18 and the standard deviation value is 10.551. The obtained *t*-value 1.432 is less than the and the standard table *t*-value 1.684 at df (38) at 0.05 level of significance. Since the obtained *t*-value is

less than the standard table t-value, the null hypothesis – “There is no significant difference in the academic achievement of students of government and private schools in online mode of learning” is accepted and the research hypothesis – “There is a significant difference in the academic achievement of students of government and private schools through online mode of learning” is rejected.

Findings of the Study

The purpose of the present study is to compare the academic achievement of students through online and offline modes of learning. The following are the findings of the study.

- There is no significant difference in the academic achievement of students between the online and offline modes of learning.
- There is no significant difference in the academic achievement of boys and girls through online mode of learning.
- There is no significant difference in the academic achievement of students of government and private schools through online mode of learning.

Discussions

The first hypothesis of the study was “There is a significant difference in the academic achievement of students between online and offline modes of learning”, but after the study was done, the findings revealed that, “There is no significant difference in the academic achievement of students between online and offline modes of learning”.

The reason behind this finding could be, the teachers may have taken online mode very seriously and taught them well and the students may also have attended the online classes with interest and concentration and understood well and they have written their exam well.

Though it was online mode, it did not differ much from the offline mode. Though it is a virtual platform, the medium did not pose as a barrier for learning.

Therefore, there is no significant difference in the academic achievement of students between the online and offline modes of learning.

The second hypothesis of the study was “There is a significant difference in the academic achievement of boys and girls through online mode of learning”, but after the study was done, the findings revealed that, “There is no significant difference in the academic

achievement of boys and girls through online mode of learning”.

The reason behind this finding could be, as the students were at home, they must have been under the strict monitoring of their parents and the boys also have attended the classes with interest and concentration and understood well, they also have written their exam well. So the gender did not make any difference in the academic achievement in the online mode of learning.

Though it was boys or girls, they consider it to be a class. Teachers’ approach for both boys and girls may be the same. Even students responded to the teacher in the same manner.

Therefore, there is no significant difference in the academic achievement of boys and girls through online mode of learning.

The third hypothesis of the study was “There is a significant difference in the academic achievement of students of government and private schools in online mode of learning”, but after the study was done, the findings revealed that, “There is no significant difference in the academic achievement of students of government and private schools through online mode of learning”.

The reason behind this finding could be, since the pandemic came all of a sudden, the government may have given strict rules to teachers to follow online mode very seriously. There may be strict monitoring from the higher officials, so, teachers may have taken the online mode very seriously and implemented the online mode as per the rules of the government.

Though it is a government or private school, the type of school management did not make any difference in the academic achievement of boys and girls through the online mode of learning.

Therefore, there is no significant difference in the academic achievement of students of government and private schools through online mode of learning.

Educational Implications of the Study

Since the present study revealed that there is no significant difference through the online and offline modes of learning, some topics can be covered via blended learning. Blended online learning offers tremendous benefits to all the stakeholders involved in the learning process.

Blended learning is a combination of offline and online education which enables students to interact with the instructor, study material, and other students both through physical

classroom and online platforms.

- The progression in digital methods for education was imminent even before the unpredictable onset of COVID-19. However, this pandemic consequently redesigned the scenario of education rapidly and made us realize the importance and need for technology in education.

As COVID-19 forced the requirement for social distancing, this outcome hit every sector significantly, which includes education. Students and teachers faced diverse challenges in these difficult times of COVID-19, giving rise to methods that can help avoid social interaction and at the same time, ensure the continuation of quality education.

- Students and educational institutes were forced to adopt distance learning methods like e-learning, virtual classrooms, online repositories, etc. It is justified to deduce that the integration of information technology in education has been accelerated by the pandemic. This crisis opened gates for opportunities in the education sector for the incorporation of digital methods.

COVID-19 has also proven that integrated learning is very convenient and flexible for both the learners and teacher, which makes it safe to assume that online education will eventually become an integral component of the education system.

The following are the educational implications for teachers and students:

- Blended learning can encounter the risk of social isolation that could be brought on by online learning. Using blended learning environments, educators can facilitate the social interaction and peer-to-peer bonding that forms a crucial part of the learning experience.
- Educators have access to several online tools that effectively record and measure student progress. This makes it easier to monitor and assess a student's engagement with the course, their performance, and the level of help they require, in an easier manner. This mode of learning also doesn't restrict learning and interaction to just on-campus hours. Chat rooms, discussion groups, and other social media tools allow students and teachers to stay in touch consistently and provides for better student engagement and support. Blended online learning saves a significant portion of the costs associated with the learning location and physical learning material in a traditional learning environment.
- Blending learning helps students to explore technology and use different tools or techniques for learning, for example, PowerPoint, Virtual classrooms, Video lectures, etc.

- Blended learning can help personalize education for each of the unique students you teach, while making lessons more effective.
- Blended learning methods enable students to explore information or guidance online, which can be accessed any time they need and classroom learning helps to build better relations between the learner and the teacher.
- Blended learning consolidates the best of both traditional and digital methods of education. While classroom learning is important to incorporate overall discipline, online learning helps students to customize their workloads, meet diverse learning abilities, and support students at home or in the classroom.
- Online classes provide teachers with a number of online learning tools including videos, audios, animations, virtual whiteboards, virtual conference rooms and live chats with the students. On the other hand, offline classes provide students with a practical learning environment within the walls of a physical classroom.
- Education is not just about academics but also learning time management, discipline, and blending learning helps both students and teachers to learn according to their own pace and schedule.
- Blended learning improves the quality of education and information assimilation while making teaching more efficient and productive.
- Blended learning makes it easy for learners to communicate about their assignments, announcements, test results or anything else they might need to know from their teachers and makes assessment and evaluation more personalized and effective.

Research showed that students using blended learning achieved similar results as traditional course structure and increased the satisfaction ratings of the participants as well. The past year and the pandemic have reinforced the fact that life is unpredictable and we need to brace ourselves and be ready to survive this fickle nature of existence. Similarly, the education system needs to adopt methods like blended learning to ensure that the process of learning that never stops. Now, since the pandemic is gradually receding and life is starting to return to normal functioning, opportunities like blended learning in the education sector have emerged to ensure a much more practical and convenient learning experience.

Limitations of the Study

The delimitations of the present study are stated as follows:

- Due to the constraints of time and resources, the study is limited to 40 students, 20 students from government school, and 20 students from private school, which restricted the scope of generalization. If there was more time allotted for the research, the study could be conducted on a larger sample.
- The study is taken up at high school level. It can be conducted at primary, secondary, higher, colleges and university level.
- The study is analyzed quantitatively. The qualitative aspects can also be analyzed.
- The study is limited to one government and one private school. The study could be carried out in more government, private, corporate and missionary schools.
- The study is confined to few variables. There are many other variables associated with the academic achievement of students, like flexibility, environment, accessibility, time management, student-teacher interaction, technical issues, etc., which may affect the students' performance could also be considered.
- The study is limited to Telangana State. It could be extended to other places also. Therefore, more empirical evidences would be required from more samples before ample generalization may be made. In light of this, it is suggested that a similar but more elaborate study may be conducted using a larger sample and covering urban, rural, districts, state and national level students.

Suggestions for further Study

The suggestions for further study are stated as follows:

- This study is limited to check the performance of students, so in the future, the stress and anxiety level of students in online and offline modes of learning can be studied with similar kind of conditions.
- This study is limited to students, so in the future, the parents influence on online and offline modes of learning could be studied with similar kind of conditions.
- This study is limited to check the performance of students so in the future, the performance of teachers could be checked with similar kinds of conditions.

- The study is taken up at high school level. It can be conducted at primary, secondary and higher, colleges and university level.
- The current research is only limited to theory classes; therefore, it can be implemented to check students' achievement in practical sessions too.
- The study is limited to a smaller geographical area; thus, a similar but more elaborate study may be conducted using a larger sample over multiple cities and states which can give better comparative results to understand the student's academic achievement.
- The study is confined to few variables. There are many other variables associated with the academic achievement of students like environment, accessibility, time management, flexibility, student-teacher interaction, technical issues, etc., which may affect the students' performance, can also be considered.

Conclusion

The sudden outbreak of COVID-19 in various part of the world in 2020 has severely affected the education system in various countries. All Educational institutions were enforced to cancel the offline mode of learning and shift to the online mode of learning to prevent the spread of COVID-19. Hence, it was felt necessarily to make an attempt to see the difference between online and offline modes of learning and its effect on the academic achievement of students. The present study focuses on the comparison between both the online and offline modes of learning and how it affects the academic achievement of students with respect to modes of learning, gender, and types of school management.

Since decades, researchers have argued upon the superiority of the online and offline modes of learning, both of which have their own pros and cons. Some of the scholars are in favor of online mode of learning whereas some are in favor of offline mode of learning. Both of these offer a lot of opportunities as well as certain challenges.

The results of the study revealed that there isn't a significant difference in students' academic achievement when they opted online or offline mode of learning. Both methods were found to be equally effective in enhancing student understanding and comprehension of the topics.

However, it is evident that the study favors both the methods in a more or less equal proportion. Neither of the methods is favored in all aspects. Thus, superiority of one method over the other is not conclusively established. Moreover, it is felt that using a mixture of the two methods which is also called as blended learning is the best way to maximize the students' academic achievement.

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A Framework of Learning Analytics to Reshape Learning in

St. Ann's College of Education

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ABSTRACT

Based on a strong theoretical background a Learning Analytical Framework (LAF) was developed to reshape the teaching learning process at St. Ann's College of Education. The implementation and evolution of the framework continued for three consecutive years. This study aims at the effectiveness of LAF and its impact on the academic performance of the B. Ed students out-going batch. Data mining techniques were used to export data from the college's database. The results show that there is significant improvement in the academic performance of students from 1st to the 2nd semester. There was also a significant difference among the students of different methodologies in the 3rd semester. Results from the study would be used to inform and evolve the LAF.

Keywords: *Learning Analytic Framework (LAF), academic performance, reshape, teaching learning process, methodologies.*

Introduction

Digital technology has influenced both teaching and learning practices in higher education. Trends and patterns generated through data mining are analysed to comprehend and substantiate student learning (Schumacher & Ifenthaler, 2018). The integration of all these processes came to be known as Learning Analytics (LA). Johnson et. al. (2012) in Horizon Report 2013 identified learning analytics as a most important trend in technology enhanced learning and teaching. Siemens (2010) conceptualized LA as the use of intelligent data, learner produced data, analysis models to discover information and social connections to predict, advise and improve on student learning experiences. The theoretical basis of this study is an offshoot of Learning Analytics (LA) as defined by Elias (2010) a tool for measuring, collecting, analyzing, and reporting data about learners and their context for the purpose of understanding and optimizing learning. The in-built data mining capability of LA was tapped into by the College to develop practices to accommodate the educational needs of diverse learners. One such practice was adapting the conventional LA Environment to design a Learning Analytic Framework (LAF) which would be used to personalize the learning environment of the B. Ed students.

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Objectives of the study

The College efforts were channeled into coining the following objectives:

1. Mapping the LAF
2. Identifying the major and minor components involved in LAF
3. Assessing the learning outcomes
4. Evolving LAF

The authors proposed there would be a significant difference in the semester-wise academic performance of the learner after the implementation of LAF.

Thus, the LAF would enable the College to:

1. use educational data to improve educational outcomes for students and the institution;
2. communicate data trends through visualization;
3. establish indicators of concepts such as knowledge construction, creativity, self-directed learning, sense of community, assessing academic programs, and designing structured activities for creating individualized learning environments;
4. use information to redesign curriculum and make room for individualized learning environments; and
5. prepare pre-service teachers for 21st century learning.

It was expected that the implementation of the LAF would culminate in:

- cognitive gains
- improvement in social meta-cognition
- pedagogical content knowledge
- deeper understanding of students' experiences
- improvement in emotional connect

Review of Related Literature

The reviewed literature underscores the critical role of learning analytics in understanding student engagement, predicting performance, and improving educational outcomes.

Student Engagement and Performance Prediction: Several studies have explored the role of student engagement in predicting academic performance and retention. Aguiar et al. (2014) examined the use of electronic portfolios to assess student engagement and predict first-semester engineering student retention, highlighting the impact of active participation in learning environments. Similarly, Sinclair and Kalvala (2015) analyzed engagement measures in massive open online courses (MOOCs), emphasizing the need for refined analytics to track and improve student retention. Grau-Valldosera and Minguillón (2011) redefined dropout patterns in online higher education, identifying key factors influencing student persistence.

Longitudinal and Comparative Studies on Student Performance: Longitudinal studies provide a deeper understanding of student performance over time. Asif et al. (2015) conducted a study analyzing students' academic progress across multiple years, highlighting the influence of various factors on long-term academic success. Gašević et al. (2014) conducted a data-driven analysis of the MOOC Research Initiative, identifying research trends and gaps in online learning environments. These studies underscore the necessity of extended tracking periods to derive meaningful insights into student learning patterns.

Learning Analytics Frameworks and Applications: The development and application of learning analytics frameworks have been a focus of research in educational technology. Scheffel et al. (2012) discussed key action extraction techniques for learning analytics, contributing to the automation of educational data analysis. Lotsari et al. (2014) introduced a student profiling methodology, demonstrating the potential of predictive modelling in learning analytics. Similarly, Prinsloo et al. (2012) addressed the challenges and opportunities in implementing learning analytics within large-scale distance education institutions, emphasizing the importance of ethical considerations and data privacy.

Technological Interventions in Learning Analytics: Technological advancements have significantly influenced learning analytics applications. Manso-Vázquez and Llamas-Nistal (2015) proposed a monitoring system to support self-regulated learning processes, facilitating personalized educational experiences. Hecking et al. (2014) analyzed dynamic resource access patterns in blended learning courses, highlighting the impact of technology-mediated interactions on student learning. Johnson, Adams, and Cummins (2012) provided insights from the NMC Horizon Report, predicting future trends in higher education technology, including the growing role of analytics in personalized learning.

Assessment and Feedback Mechanisms: Effective assessment and feedback mechanisms are crucial for student success. Vozniuk, Holzer, and Gillet (2014) explored peer assessment based

on social media course ratings, demonstrating the role of collaborative evaluation in enhancing learning outcomes. Schumacher and Ifenthaler (2018) examined the importance of students' motivational dispositions in learning analytics, emphasizing the need for adaptive assessment strategies. Tervakari et al. (2013) developed a learning analytics model for TUT Circle, an online learning environment, showcasing the benefits of real-time feedback in improving student performance.

Future Directions and Challenges in Learning Analytics: Despite advancements, several challenges remain in the field of learning analytics. Siemens (2010) provided a foundational definition of learning analytics, outlining its potential and limitations in educational research. Comparative studies, such as those suggested by Asif et al. (2015) and Scheffel et al. (2012), emphasize the need for ongoing refinement of analytical models. Future research should explore the integration of socio-psychological factors, as highlighted by Schumacher and Ifenthaler (2018), to develop more holistic approaches to learning analytics.

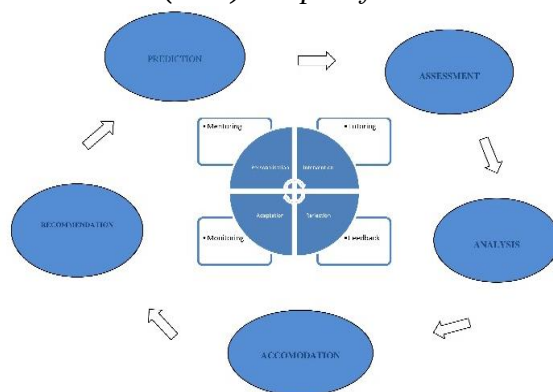
Methodological Procedures

The study attempted to quantitatively analyze the learning gains, investigate how to minimize the learning gaps and maximize the learning curves. Presented below are the results of the statistical analysis performed using the cumulative scores (Semesters 1, 2 and 3) of each student of the 2017-2019 B.Ed. batch from Social Sciences, Mathematics, and Biological Sciences using SPSS.

LAF was taken to be the independent variable and the cumulative academic performance in each semester became the dependent variable. The design of the adapted LAF is presented in Fig. 1.

Figure 1

Learning Analytics Framework (LAF) Adapted for St. Ann's College of Education.



This layered framework presented in Fig. 1 above included: The Outer Crust, the Middle Layer, and the Center Core. Detailed description of each layer follows.

The Outer Crust includes:

Predictions: Expected learning outcome, behavioral modifications, attitudinal changes, individual learning pathways, success rates, career trajectories and exit behaviors are formulated in collaboration with the students.

Assessments: Self-assessment, benchmarks designed during the induction sessions, continuous assessment through written exams, seminars, practical, project work, field studies, co-curricular competitions, showcasing, viva-voce, in-house and school-based internship programs are analyzed.

Analysis: Assignments and any written submissions are checked for plagiarism; local and global comments are provided with a scope of re-submission after improvement. Through continued observation student strengths are identified and harnessed to maximize their potentials. All evaluations are sent to the examination cell for data mining and analysis.

Accommodations: Post analysis remedial interventions, customized bridge/certificate courses are designed for mastery level learning, enhancement of language skills, upgrading of contextual knowledge and personality development.

Recommendations are made at faculty level for curriculum redesigning. Proposals are made for approval by the different statutory bodies. Approved recommendations are put into practice. The outer core gives directions to the middle layer. The middle layer comprises of:

Monitoring: Academic performance and participation, co-curricular activities, assembly participation, on-campus and off-campus student engagement at the faculty level as well as at the peer-group level. All curricular and co-curricular programs are meticulously monitored by the head of the institution. During internship, the B. Ed students are under the guideship of master teachers in their allocated schools. Monitoring and criteria-based evaluation by the jury is included in the grading process.

Mentoring is offered as a four-tiered program (Big-Sister Approach, Peer-to-Peer, Surrogacy and Pastoral) to secure the psycho-social well-being of the students. Mentoring has positively impacted the College teaching learning experience. During the ice- breaking session freshers are given a platform to interact with their seniors and from there on the bonding continues.

Peers help each other with assignments, exchange class notes, evaluate each other's work, go over difficult topics and concepts, and lend a sympathetic ear to personal problems. Each student is assigned a surrogate faculty member as a mentor at the beginning of the first semester. This mentor-mentee relationship continues until the mentee graduates. The faculty mentor monitors the mentees attendance, academic performance, co-curricular participation and community engagement, keeping a close watch on the mentee's overall welfare.

Faculty advisers have regular meetings with their mentees to address their academic goals and concerns. Unscheduled meetings with faculty advisers are also common. Faculty members liaise with each other and obtain feedback on mentees' progress, particularly those who appear to be lagging. The Principal shepherds the student flock on all matters of concern.

Data is mined through evaluation (peer, mentee, pastoral and self). The data is consolidated and credited to derive the results.

Tutoring is through participatory discussions, team-teaching, group activities, flipped networking, and social networking (e.g. WhatsApp, Blogs, email). Each lecture is followed by lab with emphasis on practical application, synthesis and creation of knowledge. An interdisciplinary approach is fostered in the tutorial sessions e.g. students learn how to design and develop digital teaching learning material for their respective methodologies. These aspects not only contribute to the professional development of the students but are also credited.

Feedback is continuous both oral and online. Student Council members present their feed-back through intermittent meetings. Every student is required to submit faculty evaluations online using a structured Google form. Subject-wise feedback regarding classroom management, overall presentation, lecturer's treatment to the syllabus and subject matter, guidance outside the classroom, understanding of classroom problems, attitude towards slow learners and modalities of the test are elicited and analyzed. Structured Principal evaluation feedback consisting of professional aspects, accountability, visionary, and supervised duties is collected, analyzed and acted on. Quality assurance feedback is gathered, statistically analyzed, and suggestions of improvement are incorporated.

Mentoring, monitoring, tutoring and feedback leads to personalization, intervention, reflection and adaptation.

Personalization: Using the mined data and the patterns that arise after analysis, the mentors and the faculty recommend and design the teaching learning process personalizing it to meet the needs of the concerned student. All mentors are familiar with the interventions and extend support on a case-to-case basis as the need arises. The personalized intervention results in improved learning which is accounted for in the final grade.

Intervention: is a three step process as listed below.

Step 1: Identifying the existing gaps in the system by:

1. detecting students with learning difficulties or inability to organize learning processes through observation, various tests (content, paper pencil, graded complexities of application-based MCQs and standardized psychological tests).
2. clustering students into groups based on their learning styles, area of interest and interaction, patterns of group projects, classroom activities, club activities (Aguiar et. al., 2014; Asif et. al., 2015, Scheffel et al., 2012).
3. Social network analysis through textual analysis of WhatsApp, blogs, chats, webpages, and documents help to understand the learner better (Gasevic et. al., 2014; Lotsari et. al., 2014; Prinsloo et. al., 2012).
4. interpretation of the structure and their relations in collaborative activities such as group work, group projects, classroom activities etc. (Hecking et. al., 2014; Tervekari et.al., 2013; Vozniuk et. al., 2014).
5. identifying relation in learner behavior patterns and diagnosing student difficulties on an individual basis. Students with language barriers are provided academic support with translated handouts and off-classroom informal instruction.

Step 2. Design and implement personalized interventions

New teaching approaches are designed and intervention programs are scheduled (Grau-Valldosere and Minguillom, 2011; Manso-Vazqua and Lamas-Nistal, 2015; Sinclari and Kalvala, 2015).

Step 3. Action research is taken up by the tutors for effective learning experience. Reflection:

Reflecting on their own learning process, the students document their reflections and dispositions including best artifacts in an online portfolio which is evaluated every semester and culminates

in a final presentation at the end of the fourth semester. Students also maintain a reflective journal throughout their internship programs which are submitted for evaluation at the end of the course.

Adaptation: The learners are adapted to teach under any circumstances and in any learning environments. They are equipped to face any professional challenges that threaten the teaching learning process.

Findings and Discussion

A one way ANOVA was conducted to compare the effect of LAF on the academic performance of the B.Ed. students.

Table 1
Semester wise Differences in the Academic Performance of B. Ed Students

Description		Sum of Squares	df	Mean Square	F	Sig.
Semester 1	Between Groups	261.884	2	130.942	1.328	.271
	Within Groups	7493.122	76	98.594		
	Total	7755.006	78			
Semester 2	Between Groups	195.349	2	97.675	1.424	.247
	Within Groups	5214.450	76	68.611		
	Total	5409.800	78			
Semester 3	Between Groups	655.319	2	327.659	4.656	.012
	Within Groups	5348.416	76	70.374		
	Total	6003.735	78			

F (2, 76) Critical value = 3.12

The observed f value in the 3rd semester ($f=4.66$) is greater than the F critical value and significant at $p<.012$. There is a significant difference among the groups in the 3rd semester. No significant difference was observed among the groups of the three methodologies in their learning in the 1st and the 2nd semesters. A paired sample t test was run to ascertain the differences within the semester. The results are presented in Table 2 below:

Table 2

Mean, Standard Deviation and t-value of the differences in academic performance within the semesters.

Semester					
No.	N	Mean	SD	t-value	significance level
1	79	61.05	8.42	15.40	Significant at 0.05 level
2	79	74.46	8.32	1.28	
3	79	75.93	8.77		NS

t- value df(78) 1.99

Table 2 indicates there is a steady improvement in the mean value with similar variation in the three semesters. The obtained t -value ($t=15.40$) is significant at 0.05 level, thus there is a significant improvement from Semester 1 to Semester 2. This is possible because a lot of theoretical input in different areas to strengthen teaching is in the first two semesters. Table 2 also shows no significant improvement in the 3rd semester as the t -value ($t= 1.28$) is less than the critical value. As Semester 3 initiates the applications of concepts in the school environment with internship, probably learning is not obviously seen in the academic scores of the learner. However, skill based learning is enhanced in Semester 3.

Further, to analyze the difference within the groups, during the 3rd semester an independent sample t -test was employed. Results are presented in Table 3.

Table 3

Mean, Standard Deviation and t-value of the academic performance among B. Ed students in Semester 3.

Methodology	N	Mean	S.D	t-value	Significance level
Mathematics	21	78.67	6.5	8.11	NS
Biological Sciences	19	78.88	4.48	2.99	
Social Sciences	39	73.01	10.43		

t-value = 2.021, t-value = 2.00

From Table 3 it can be concluded that there is no significant difference in the academic performance of between the Mathematics and the Biological Sciences methodologies students whereas in comparison the students from Mathematics and Social Sciences methodologies and the students from Biological Sciences and Social Sciences show a significant difference, the t -value ($t=2.99$) is higher than the table t -value (2) at 0.05. The mean score of Biological Science Students ($M=78.88$) is greater than the mean score of Social Sciences Students ($M=73.01$). Probably the social science curriculum needs to be redesigned and made more scientific to include higher order thinking skills.

Conclusion

Learning Analytics has been adapted by the Institution to reshape the teaching learning process. The basic framework needs to be continuously modified keeping in mind the changing needs of the learner. Learners must be exposed to challenging learning environments. A technological software connecting input from faculty, administration and examination cell is to be developed to track individual student learning. Confidentiality and privacy of the learner should be respected. Students should have access to information regarding their performance to catapult them out of their comfort zones and wander into the uncharted territories of learning. The software should also be able to track the depletion of learners' performance and alert or appraise the improvement in performance. Learning Analytics trends can pave the way to maximize the learning curve in the long run.

Limitations and Suggestions for further Research

This study faced several limitations that should be considered when interpreting the findings. The sample size was limited to the 2017-2019 B.Ed. batch within a single institution, restricting the generalizability of the results to other educational settings. Additionally, the Learning Analytic Framework (LAF) was specifically designed for St. Ann's College of Education, and its applicability to other institutions, disciplines, or educational levels remains untested.

Another limitation was the absence of longitudinal data. While academic performance was tracked over three semesters, the study did not examine long-term impacts on students' professional growth or teaching effectiveness after graduation. Furthermore, while statistical analysis indicated academic improvements, the study did not quantitatively assess skill-based learning outcomes, particularly those gained during internships. External factors such as socio-economic background, personal motivation, and prior academic performance, which could have influenced learning outcomes, were also not accounted for. Additionally, while feedback

from faculty and students was incorporated, potential biases in self-reported data were not addressed.

To build upon these findings, future research should expand the study to other educational institutions and disciplines to evaluate the broader applicability of LAF. A longitudinal study tracking students beyond graduation could provide insights into whether LAF contributes to their teaching competencies and professional success. Further research should also integrate qualitative and quantitative assessments of skill-based learning, including pedagogical skills, classroom management, and technological adaptability.

A comparative analysis between LAF and other learning analytics frameworks could help identify best practices and areas for improvement. Additionally, exploring socio-psychological factors such as students' socio-economic status, motivation, and self-efficacy could offer a more comprehensive understanding of LAF's effectiveness. Finally, refining data collection methods—such as incorporating anonymized feedback or third-party evaluations—could help mitigate biases and enhance the reliability of self-reported data.

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Enhancing Listening Skills of Preservice Teachers Using ELT Laboratory

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ABSTRACT

To improve preservice teachers' listening abilities, an ELT laboratory intervention was carried out. The research paper presented here aims to investigate the level of awareness about communication skills that preservice teachers have, determine whether exposure to an ELT laboratory environment affected preservice teachers' listening skills, and compare achievement scores before and after the intervention. At the intervention's efficacy evaluation stage, paired t-tests and correlation analyses were among the descriptive and inferential statistical analyses carried out on the sample size of 20 preservice teachers. A piloting exercise validated a research tool that included 27 questions across five areas in listening skills. The results showed that the mean achievement scores of the experimental group significantly improved. The statistically significant difference supports the research hypothesis, underlining the likelihood of the ELT laboratory in enhancing listening skills and improving the general academic performance among preservice teachers. Future studies must be designed with representative samples, using longitudinal methodologies that tease out the efficacy of such interventions. It would also follow that teacher education requires tailored approaches toward sub-skill areas within listening skills. Eventually, improvements in listening competencies could lead to enhancements in academic achievement and career readiness for pre-service teachers.

Keywords: *Enhancing, Listening Skills, Pre-service Teachers, ELT Laboratory*

Introduction

Can using an English Language Teaching (ELT) laboratory help enhance the listening skills of pre-service teachers? Naturally, good listening skills are a prerequisite for effective language learning and teaching; hence preservice teachers should develop their ability to listen, which will help them better attune to the needs of students they may teach in any new languages. For this purpose an ELT laboratory has been established to understand how it can better help in fostering the listening abilities of preservice teachers. The goal is to equip future generations of learners with skills by training preservice teachers as attentive and empathetic listeners who can thereby lay the foundation for a strong foregrounding in language education.

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This study aims to make preservice teachers more skilled by creating an interactive language learning environment that is supportive.

Research Questions

1. Are preservice teachers aware of the communication skills in English?
2. Do preservice teachers differ in their listening skills?
3. Can the listening skills of preservice teachers be improved with the help of an ELT laboratory?

Objectives of the study

1. To study whether the preservice teachers are aware of the importance of communication skills.
2. To study the impact of ELT lab on the listening skills of pre-service teachers.
3. To compare the achievement scores of pre-service teachers before and after the intervention program.

Hypotheses of the study

H₁: There is a significant difference in the listening and writing conversations skills of the pre-service teachers before and after the intervention program.

H₂: There is a significant difference in the listening and comprehension skills of the pre-service teachers before and after the intervention program.

H₃: There is a significant difference in the listening and summarizing skills of the pre-service teachers before and after the intervention program.

H₄: There is a significant difference in the listening and directing skills of the pre-service teachers before and after the intervention program.

H₅: There is a significant difference in the listening and phrasing skills of the pre-service teachers before and after the intervention program.

H₆: There is a significant difference in the achievement scores of the pre-service teachers before and after the intervention program.

Variables

- **Independent Variable:** ELT Laboratory intervention program.
- **Dependent Variables:** Achievement Scores of the pre-service teachers.

Methodology

The present study has employed an experimental method. The researcher has prepared a standardized tool of using ELT Laboratory for pre-service teachers by pilot testing and conducted interventions for the treatment group for the effective outcomes of the study.

Sample

20 Preservice teachers from St. Ann's College of Education, Secunderabad.

Research tools used in the study

The research tool comprises 27 questions with 5 Sections i.e., Section-A, Section-B, Section-C, Section-D and Section-E respectively

Q. No. 1-5 –Listening and Conversation (Sec A)

Q. No. 6-10 Listening and Choosing (Sec B)

Q. No. 11-12 Listening and Summarizing (Sec C)

Q. No. 13-17 Listening and Directing (Sec D)

Q. No. 18-27 Listening and Phrasing (Sec E)

Analysis of the Data

Hypothesis 1

H₁: There is a significant difference in the Listening and Conversational skills of the pre-service teachers before and after the intervention program.

Table 1

Mean, Standard deviation and t-value of Listening and Conversational skills of pre-service teachers before and after the intervention program.

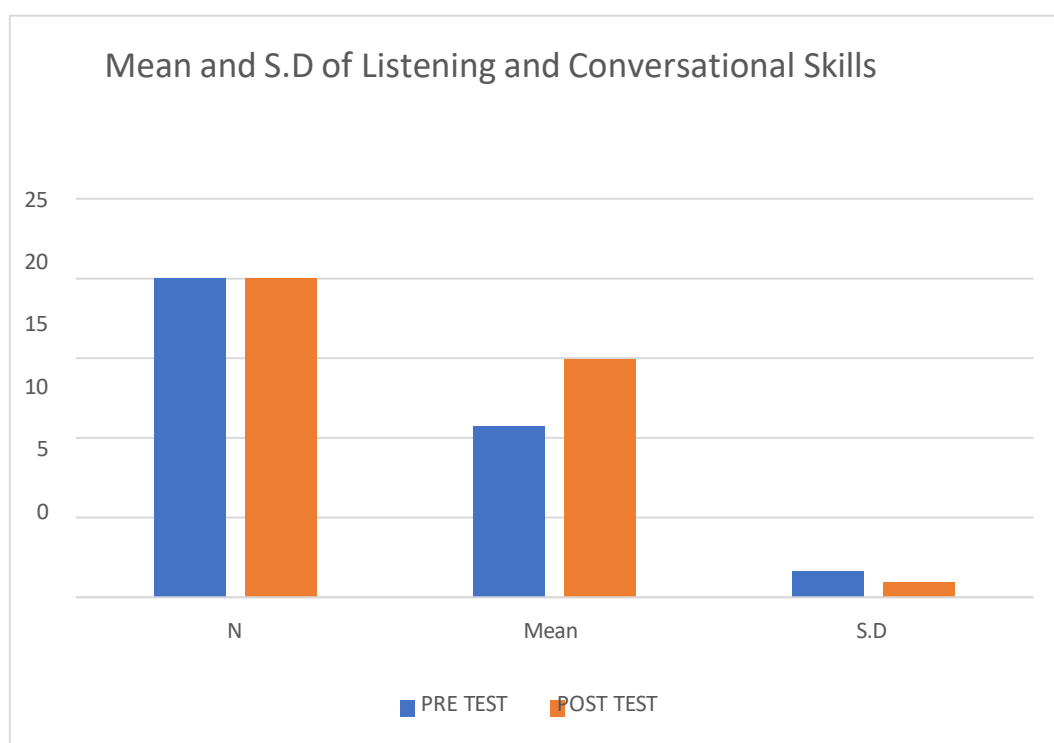
Listening and Conversation	Size (N)	Mean	Standard Deviation	t- value	significance level
Pre test	20	10.75	1.66	12.45	Sig at 0.05 Level
Post test	20	14.95	0.94		
df =19, t-value = 2.093					

Interpretation

The results of the data analysis showed that, the mean scores of the experimental group in a paired t-test are: pre-test ($M=10.75$) is less than the post-test ($M=14.95$). The standard deviation scores of the experimental group in a paired t-test are: pre-test ($S.D=1.66$) is more than the post-test ($S.D=0.94$). The obtained t-value is ($t=12.45$) which is greater than the table t-value ($t=2.093$). As the obtained mean scores, standard deviation scores and the t-value showed variation, there is a significant difference in the Listening and Conversation skills of the preservice teachers before and after intervention. The obtained t-value is more than the table t value (2.093) at df 19. Hence, null hypothesis (H_0) is rejected and research hypothesis (H_1) is accepted.

Figure 1

The Mean, Standard deviation and t-value of the Listening and Conversational skills of the Pre-service teachers.



Hypothesis 2

H₂: There is a significant difference in the Listening and Comprehension skills of the pre-service teachers before and after the intervention program.

Table 2

Mean, Standard deviation, and t-value of the Listening and Comprehension skills of the Pre-service teachers before and after the intervention program.

Listening and Comprehension	Size (N)	Mean	Standard Deviation	t-value	Level of significance
Pre test	20	2.00	0.97	10.28	Sig. at .05 Level
Post test	20	3.35	0.81		

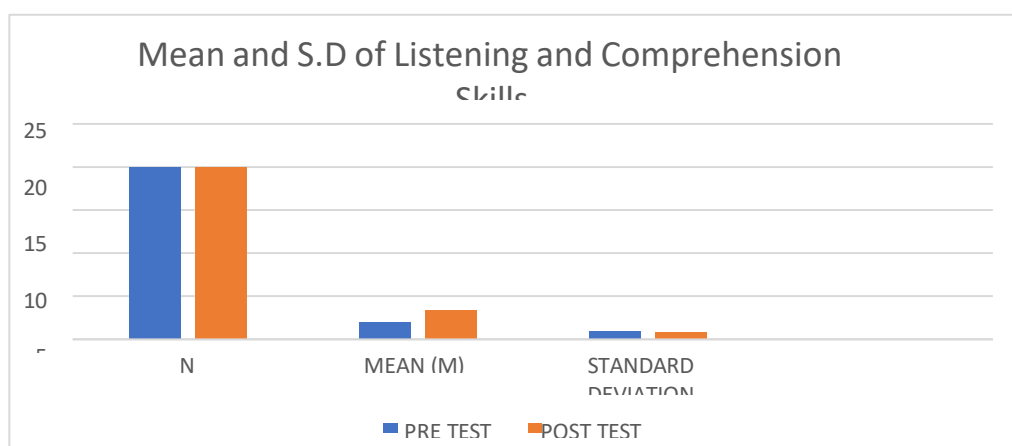
df = 19, t-value = 2.093

Interpretation

The results of the data analysis showed that the mean scores of the experimental group in a paired t-test are: pre-test (M=2.00) is lesser than the post-test (M=3.35). The standard deviation scores of the experimental group in a paired t-test are: pre-test (S.D=0.97) is more than the post-test (S.D=0.81). The obtained t-value is (t=10.28) is greater than the table t-value (t=2.093) at df 19. Hence there is a significant difference in the Listening and Comprehension skills of the preservice teachers before and after intervention. Hence, null hypothesis (H₀) is rejected and research hypothesis (H₂) is accepted.

Figure 2

Mean and Standard deviation of the Listening and Comprehension skills of the Pre- service teachers before and after the intervention program.



Hypothesis 3

H₃: There is significant difference in the Listening and summarizing skills of the pre-service teachers before and after the intervention program.

Table 3

The Mean, Standard deviation and t-value of the Listening and summarizing skills of the Pre-service teachers before and after the intervention program.

Listening and Summarizing	Size (N)	Mean	Standard Deviation	t-value	Level of significance
Pre test	20	2.55	0.81	4.01	Sig. at .05 Level
Post- test	20	3.30	0.98		

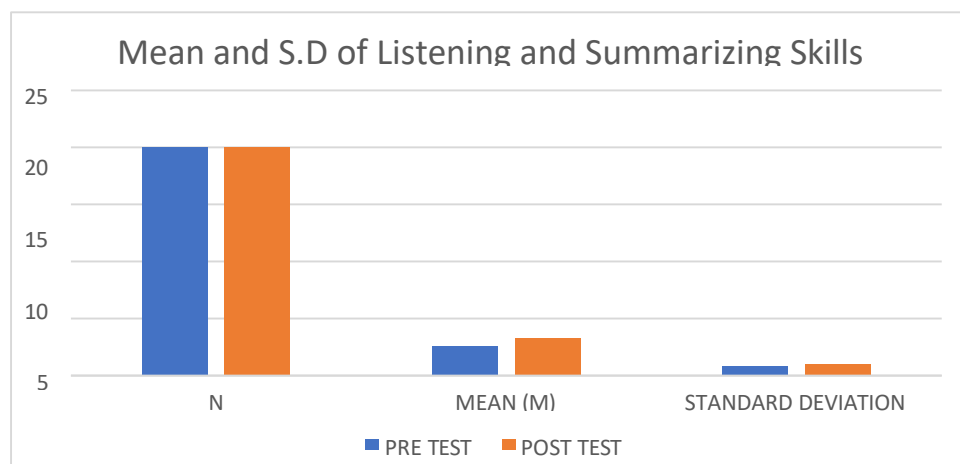
df = 19, t-value = 2.093

Interpretation

The results of the data analysis showed that the mean scores of the experimental group in a paired t-test are: pre-test (M=2.55) is less than the post-test (M=3.30). The Standard Deviation scores of the experimental group in a paired t-test are: pre-test (S.D=0.81) is lesser than the post-test (S.D=0.98). The obtained t-value is (t=4.01) is greater than the table t-value (t=2.093) at df 19. As the obtained mean scores, standard deviation scores and the t-value showed variation, there is a significant difference in the Listening and summarizing skills of the preservice teachers before and after the intervention. The obtained t-value is more than the table t value (2.093) at df 19. Hence, null hypothesis (H₀) is rejected and research hypothesis (H₃) is accepted.

Figure 3

Mean and Standard deviation illustrating the significant difference in the Listening and Summarizing skills of Pre-service teachers before and after the intervention program.



Hypothesis 4

H₄: There is a significant difference in the Listening and directing skills of the pre-service teachers before and after the intervention program.

Table 4

The Mean, Standard deviation, and t-value of the Listening and directing skills of the Pre-service teachers before and after the intervention program.

Listening and Directing	Size (N)	Mean	Standard Deviation	t-value	Level of Significance
Pre test	20	2.35	0.72	6.78	Significant at 0.05
Post test	20	3.70	0.73		

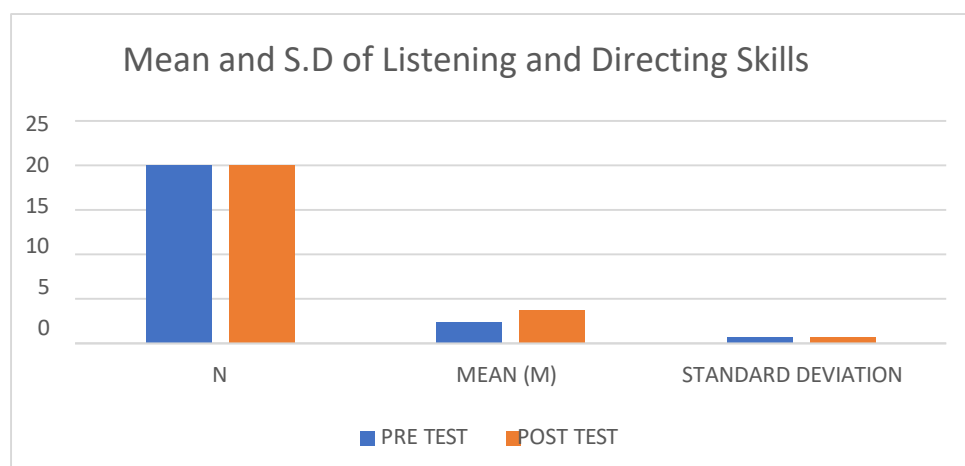
$df = 19, t\text{-value} = 2.093$

Interpretation

The results of the data analysis showed that the mean scores of the experimental group in a paired t-test are: pre-test (M=2.35) is less than the post-test (M=3.70). The Standard Deviation scores of the experimental group in a paired t-test are: pre-test (S.D=0.72) is lesser than the post-test (S.D=0.73). The obtained t-value is (t=6.78) greater than the table t-value (t=2.093) at df 19. As the obtained mean scores, standard deviation scores and the t-value showed variation, there is a significant difference in the Listening and directing skills of the preservice teachers before and after the intervention. The obtained t-value is more than the table t value (2.093) at df 19. Hence, null hypothesis (H₀) is rejected and research hypothesis (H₄) is accepted.

Figure 4

The Mean and Standard deviation in the Listening and directing skills of pre-service teachers before and after the intervention program.



Hypothesis 5

H₅: There is significant difference in the Listening and Phrasing skills of the pre-service teachers before and after the intervention program.

Table 5

The Mean, Standard deviation and t-value of the Listening and Phrasing skills of the pre-service teachers before and after the intervention program.

Listening and Phrasing	Size (N)	Mean	Standard Deviation	t-value	Level of significance
Pre test	20	3.85	1.03	3.94	Significant at 0.05 Level
Post test	20	4.60	0.68		

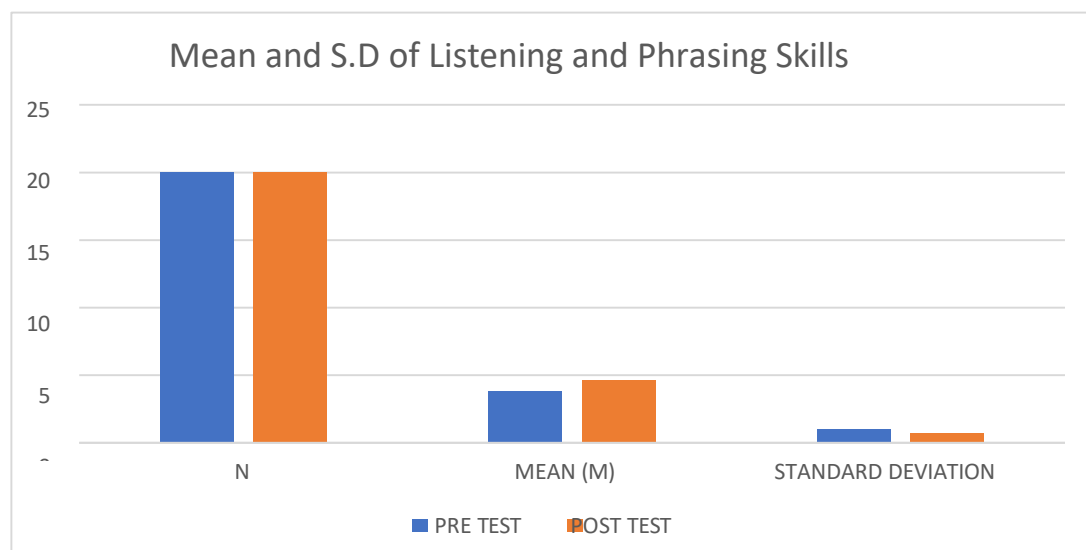
df = 19, t-value = 2.093

Interpretation:

The mean scores of the experimental group in a paired t-test are: pre-test (M=3.85) is less than post-test (M=4.60). The Standard Deviation scores of the experimental group in a paired t-test are: pre-test (S.D=1.03) is more than the post-test (S.D=0.68). The obtained t-value is (t=3.94) is more than the table t-value (t=2.093) at df 19. The obtained t-value is more than the table t value (2.093) at df 19. Hence, null hypothesis (H₀) is rejected and Research Hypothesis (H₅) is accepted. There is a significant difference in the Listening and Phrasing skills of the pre-service teachers before and after the intervention program.

Figure 5

The Mean and Standard deviation of the Listening and Phrasing skills of Pre-service teachers before and after the intervention program.



Hypothesis 6

H₆: There is a significant difference in the achievement scores of the pre-service teachers before and after the intervention program.

Table 6

The Mean, Standard deviation and t-value of the total achievement scores of the pre-service teachers before and after the intervention program.

Total Listening skills	Size (N)	Mean	Standard Deviation	t-value	Level of significance
Pre test	20	2.10	0.87	9.28	0.05
Post test	20	3.65	0.71		

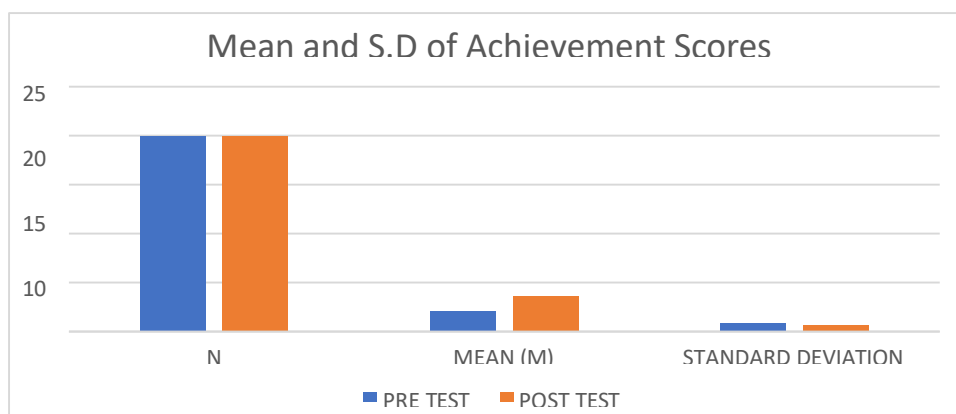
$$df = 19, t\text{-value} = 2.093$$

Interpretation

The results of the data analysis showed that the mean scores of the experimental group in a paired t-test are: pre-test (M=2.10) is lesser than the post-test (M=3.65). The Standard Deviation scores of the experimental group in a paired t-test are: pre-test (S.D=0.87) is greater than the post-test (S.D=0.71). The obtained t-value is (t=9.28) is greater than the table t-value (t=2.093) at df 19. As the obtained mean scores, standard deviation scores and the t-value showed variation, there is a significant difference in the Achievement Scores of the preservice teachers before and after the intervention program. The obtained t-value is more than the table t value (2.093) at df 19. Hence, null hypothesis (H₀) is rejected and research hypothesis (H₆) is accepted.

Figure 6

The Mean and Standard deviation illustrating the significant difference in the Achievement Scores of the preservice teachers before and after the intervention program.



Findings of the study

1. The ELT laboratory intervention significantly improved the listening and conversational skills of preservice teachers, as indicated by an increase in mean scores and a statistically significant t-value.
2. The intervention was effective in enhancing listening and summarizing skills, with a notable increase in mean scores and a statistically significant t-value, indicating a successful outcome.
3. The ELT laboratory intervention significantly improved listening, directing skills, and phrasing skills as demonstrated by an increase in mean scores and a statistically significant t-value.
4. The intervention led to a significant improvement in the overall achievement scores of preservice teachers, as evidenced by an increase in mean scores and a statistically significant t-value.

Discussion

The ELT laboratory-based intervention led to a statistically significant enhancement in the listening and conversation skills of pre-service teachers, indicating the intervention's effectiveness in these areas. The intervention showed strong positive effects on the development of summarizing, directing, comprehension and phrasing skills and overall scholastic achievement skills, providing evidence of the ELT laboratory's effectiveness in these specific areas.

Educational Implications

1. Institutions should integrate ELT laboratories and similar interventions into their syllabi to develop essential skills like listening, conversation, summarizing, and directing, ensuring measurable improvements in student performance and competency.
2. Teachers should utilize innovative tools and technologies, such as ELT laboratories, to expand their teaching methods, targeting specific skill areas where students may need improvement, informed by assessment data.
3. Policymakers should support the integration of educational technologies in schools and teacher training programs, allocating resources to enhance the quality of education and address specific skill development needs.

4. Students should actively participate in skill-enhancing educational programs and interventions, using available resources like ELT laboratories to improve their competence and achieve academic success.
5. Parents should play an active role in reinforcing the skills learned at school by engaging with their child's educational activities at home, ensuring that school-based interventions are consolidated and extended into everyday contexts.

Limitations of the study

- The present study consisted of a sample size of only 20 pre-service teachers.
- The study is limited to only one College of Education.
- The study is carried out only for 5 components of the Listening skills.
- Due to the time constraints intervention was conducted only for 7-10 days.

Further Research Opportunities

- Conduct larger, diverse sample studies and longitudinal research to better understand the effectiveness of interventions on listening and comprehension skills, including the impact of socio-economic status, past learning experiences, and individual learning styles.
- Investigate the use of advanced technological tools, digital media, and interactive platforms in enhancing listening and comprehension skills, and explore how these tools influence skill development across different educational environments and cultures.
- Examine the relationship between improved listening and related skills and their impact on academic performance and career achievement to better understand the broader benefits of these skills.

Conclusion

The study reveals that targeted interventions in listening and related skills, such as conversational abilities, summarizing, directing, and phrasing, significantly enhance pre-service teachers' competencies. However, the effectiveness of these interventions varies by skill, highlighting the need for customized approaches. The research also emphasizes the importance of longitudinal studies to assess long-term impact and suggests increasing sample diversity for broader applicability.

Furthermore, the study underscores the value of collaboration between teachers and parents in supporting skill development, suggesting that improved listening and related skills can positively influence academic success and career readiness. Overall, the findings advocate for tailored interventions, ongoing evaluation, and collaborative efforts to optimize educational outcomes.

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Effect of Play way Instructional strategy on Achievement in Number work among Preschool Students

Hajiya Mariam^{4a} Dr. Sarah Thomas^b

ABSTRACT

Mathematics has long been one of the most feared subjects among students. As such, educators have been constantly looking into different approaches to improve the smooth curriculum transaction and delivering of the subject. Learning Mathematics help students to solve problems, think critically and creatively, communicate effectively, empathize with others, cope with challenges and manage their lives in a healthy and productive manner.

Learning through play helps students to improve their memory power and also learn without burden and difficulty. NEP 2020, calls for curriculum and pedagogy in schools to be framed in such a way that Learning would be Holistic, Integrated, Enjoyable, and Engaging. This study seeks to investigate the **Effect of Play way instructional strategy on Achievement in Number work among Preschool students**. The study follows a Quasi-Experimental design. With Pre-test/Intervention/Post-test design employed to see whether the Play way Intervention program helped in the performance of Pre-school students in Number works

The result of the present study indicated significant improvement in Scholastic Achievement score of pre-school students in Number work who were exposed to play way intervention module. The findings of the study may provide information for teachers, administrators and policy makers to incorporate pedagogical practices that support play-based learning.

Keywords: *Play way Instructional strategy, Achievement, Preschool students, Number Work.*

Introduction

The Play way method, also known as Play-based method, is an educational approach that highlights learning through play and hands-on activities. The Play way method was developed by Friedrich Fröbel, a German educator, in the 19th century and is commonly associated with early childhood education, particularly for preschool and kindergarten-aged children. The method recognizes the natural inclination of children to engage in play as a means of exploration, discovery, and learning.

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In the Play way method, the classroom environment is designed to encourage play and creativity. It often includes various play areas or centres where children can engage in different activities such as pretend play, building with blocks, creating art, and engaging in sensory experiences. The activities are carefully chosen to be developmentally appropriate and aligned with the children's interests and abilities.

Review of literature

Shambharkar T (2019) conducted a study on the effectiveness of the play way method on the achievement of English language skills among Primary school students. The sample of the study comprised of 50 students of a aemi-English Marathi medium school in Nagpur city. The result showed that the play way method is effective for developing writing skills in primary-level students.

Sharma, A (2018) conducted a study on the Effectiveness of the Play way Method for Teaching children Mathematics. The sample had 41 students, 21 students were in the control group & 20 in the Experimental group who were exposed to an intervention using play way method. The result showed that children of the experimental group scored better than those in the control group.

Yusuf I.A (2019) in his study on 'The Effectiveness of Play way method on Academic Performance of Primary school pupils' in Gwale in Kano. The researcher selected a sample of 46 pupils split into two groups of 23 each. The result showed that the play way method of teaching had a positive effect on the academic performance of primary school pupils.

Kawira (2012) conducted a research on 'The influence of play method on academic performance in mathematics of pre-school children' in Kenya. The objectives of the research were to examine the influence of types of play method on mathematics performance in pre-school children; to establish the influence of attitude of children towards play method on mathematics performance and examine the influence of time allocated to play method on academic performance of preschool children. Quasi experimental research design was used and a total number of 20 public and 9 private schools were used as the population. Stratified random sampling was employed by the researcher to select the respondent from both private and public schools. The researcher established the relevance of some of the play methods that the pre- school teachers engaged children mostly while teaching mathematics. Majority of the children had a cooperative attitude towards learning and when there was adequate time

allocated to play method the performance was very high. It was therefore recommended that when play method especially music/ songs were used in teaching mathematics the performance was good. Another implication is that through play method pre-schoolers develop social domain as they interact in playing.

Nair S.M et al (2013) conducted a study on ‘The effects of using the play method to enhance the mastery of vocabulary among preschool children’. The sample consisted of 100 children split into two groups of 50 each in experimental and control group. The result showed that the implementation of the play way method can help to improve the mastery of vocabulary among preschool children as compared with that employing conventional method.

Iroegbu V.I (2017) in her study on ‘The Effect of Play Way Teaching Strategy on Primary School Pupil’s Acquisition of Basic Science Concepts’. The sample of the study was made up of 60 boys & girls in equal proportion. The result showed that the Play way teaching strategy promoted higher level acquisition of science concepts in children than their usual teacher directed play often employed at this level of education.

Delphine A.M (2016) conducted a study on ‘Effectiveness of Play Way Method in Teaching English Language Among 9th Standard Students’. The sample of the study consisted of 60 students including both male and female. The result showed that there is a difference in the Mastery level attainment among 9th standard pupils in learning English Grammar through play- way method in terms of a) Gender b) parental education c) locality.

Popoola A.A (2014) conducted a study on ‘Effect of Play Way Method on the Numeracy skills of Early Basic Education School Pupils’ in Ekiti State Nigeria. The sample consisted of 120 children split into two groups of 60 each. It was observed that play way method is more effective than demonstration method.

Jonah & Okon N (2017) studied ‘Play-way Instructional Strategy and Achievement of Pre-schoolers in number works’ in Uyo local Government area of Akwa Ibom State, carried out a study on Play-Way Instructional Strategy and Achievement of Pre-schoolers in Number Works in Uyo Local Government Area of Akwa Ibom State. The sample of the study was made up of 2,829 pupils of 110 private and government schools & 97 pupils were randomly selected. The result showed that the utilization of the play-way instructional strategy significantly enhances the development of numeracy skills among pre-schoolers.

Anthinia A.O et al (2016) conducted a study on 'Effect of Play Way Method on Interest of Primary School Pupils in Basic Science: Implications on School Counselling Practice'. The sample of the study consisted of 120 primary pupils in four intact classes from the four schools randomly selected. The result was observed that the pupils taught basic science using play-way method developed more interest than those who taught with conventional method.

Statement of the problem

“Effect of Play way instructional strategy on Achievement in Number work among Preschool students”.

Research questions

1. What is the impact of play way instructional strategy on the academic achievement of pre-school students in number work?
2. What types of activities and games are most effective in promoting learning number work using play way instructional strategy?
3. Does the use of play way instructional strategy facilitate better scores in number work with respect to problem solving, reasoning proof, communication, establishing connections, and Representation and Visualization among pre-school students? How can educators effectively integrate play way instructional strategy in their pedagogical practices to enhance academic achievement in number work, particularly among pre-school students?

Objectives of the study

The study aims to

1. study the difference in the number work scores with respect to problem solving before & after the intervention using play way instructional strategy.
2. find out whether there is a difference in the scores obtained for reasoning proof before and after the intervention using play way instructional strategy.
3. know the difference in the scores obtained for communication before & after the intervention using play way instructional strategy.
4. know whether there is a difference in the scores obtained for establishing connections before and after the intervention using play way instructional strategy.

5. analyse the difference in the scores obtained for Representation and Visualization before and after the intervention using play way instructional strategy.
6. know whether there is a difference between the Achievement scores in number work before and after the intervention using play way instructional strategy

Hypotheses of the study

- 1) There is a significant difference between the number work scores obtained for problem-solving before and after the intervention using play way instructional strategy.
- 2) There is a significant difference between the number work scores obtained for reasoning proof before and after the intervention using play way instructional strategy.
- 3) There is a significant difference between the number work scores obtained for communication before and after the intervention using play way instructional strategy.
- 4) There is a significant difference between the number work scores obtained for establishing connections before and after the intervention using play way instructional strategy.
- 5) There is a significant difference between the number work scores obtained for Representation and Visualization before and after the intervention using play way instructional strategy.
- 6) There is a significant difference between the Achievement scores in number work before and after the intervention using play way instructional strategy.

Operational definitions

Play Way instructional strategy refers to the strategies involving play which includes the use of activities to teach preschool children number work planned for a period of 10 days as an intervention module involving play. Some of the activities include Counting the objects, Puzzles, Number matching, what comes next, Hopscotch, Storytelling, Ball in the Basket, Completing the Pattern, Decoding the shapes, Play with Dice, & Roll the stick, etc.

Academic achievement refers to the attainment of a set standard of performance in a given evaluation exercise such as test, examination or series of continuous assessments. In the present study Academic performance refers to the performance of preschool students in a Scholastic Achievement test in number work covering concepts related to problem solving,

reasoning proof, communication, connections and Representation and Visualization

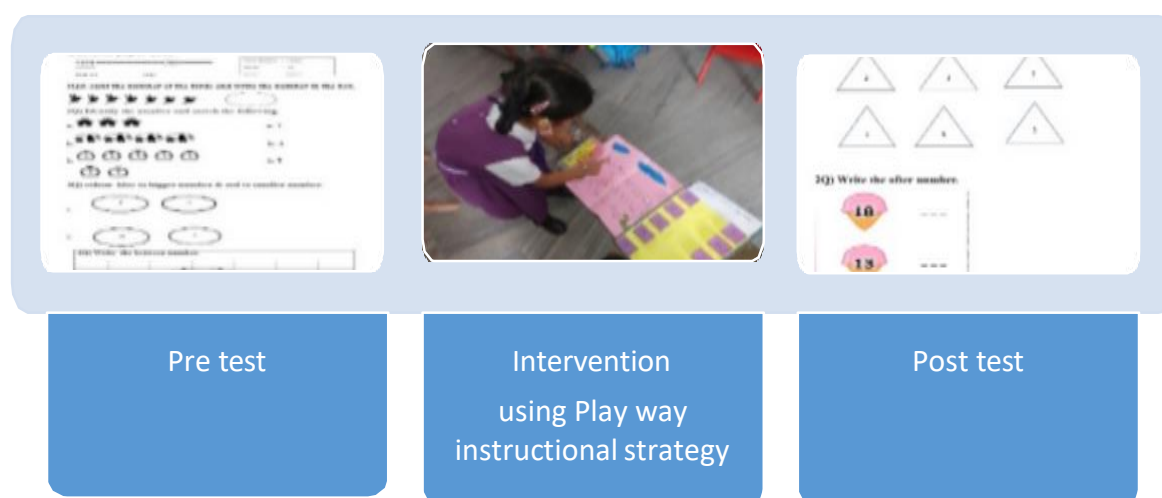
Pre-schoolers refer to children who come under the age 2-6 years. In this study students belonging to U.K.G. class was considered for study.

Number work: In this study the number work will be tested and the attainment of academic standards such as problem-solving, reasoning proof, communication, connections and Representation and Visualization in number work among the U.K.G class students is focused.

Research design

The present study followed a **Quasi-experimental design with a single group Pre –Test and Post-test design** conducted on a sample of 80 Preschool students. An Intervention module is administered to the group of Preschool students. The quantitative change in the academic achievement scores was determined for the group through a Pre –Test conducted before administering the intervention and a Post – Test conducted after administering the intervention module using Play way instructional strategy.

Research Design-Experimental design



Variables of the study

Independent variable: Play way instructional strategy used as intervention module

Dependent variable: Academic achievement (test score obtained by the preschool students for the scholastic achievement test in Number work conducted by the researcher).

Population and sample

In the present study “purposive sampling” technique has been used by the researcher. The researcher selected 80 Pre-school students from “Goutham High School”, Koratla, in Jagtial district as sample for the present study. 80 Pre-school students from 3 sections of U.K.G grade were chosen to carry out the intervention and test the hypotheses.

Tools used in the study

Based on the research objectives and hypotheses two tools were used in the present study

- Scholastic achievement test (Pre-test and a parallel form of the Pre-test as Post-test)
- An intervention module using play way instructional strategy

The Scholastic achievement test was prepared keeping the NCERT model following Bloom’s taxonomy. The Scholastic achievement test had 20 items covering the academic standards.

Table representing No. of questions as per Academic standards

Academic standards	No. of Questions
Problem solving	4
Reasoning proof	3
Communication	5
Connections	3
Representation & visualization	5

The Scholastic achievement Pre-test was administered for 80 Pre-school students from 3 sections after which the researcher administered the intervention module using Play way instructional strategy in teaching concepts like identifying the number, smaller & bigger number, missing number, before & after number, between number for a period of 10 days for the entire group of the sample through Play way instructional mode. After a gap of 2 weeks, a parallel form of pre-test was administered as post-test.

Administration of the tool and the collection of the data

After finalization of the tool, the investigator prepared blue print of the scholastic achievement test. After taking permission from the Headmaster of the selected school, the scholastic test was administered for the preschool students. The researcher conducted the Pre-test in Number work for 80 preschool students from 3 sections. The Intervention module was administered for 10 days and the schedule followed is represented in the table given below.

Schedule of Intervention module

Day 1	Counting the objects and arranging in the numbers assigned
Day 2	Identify the number
Day 3	Identify the smaller & bigger number
Day 4	Find the missing number
Day 5	Identify before number
Day 6	Identify between number
Day 7	Arranging glasses according to suitable number
Day 8	Arranging the blocks according to the given number
Day 9	Paste the dots according to the given number
Day 10	Identify after number

The Intervention module was administered on the group for a period of 10 days and after a gap of 2 weeks, a parallel form of the pre-test was administered on the sample as post-test. The respondents were requested to complete the scholastic achievement test within 1 hour. The researcher was also present in the classroom to help the students, whenever they felt difficulty in answering questions.

The Scholastic achievement test administered as Pre-test and Post-test on the mathematical concepts like identifying the number, smaller & bigger number, missing number, before & after number, between number. Bloom 's Taxonomy and weightage table relating content to Academic Standards such as **Problem solving, Reasoning proof, Communication, Connections and Representation & visualization was prepared**. The content validity was established in consultation with subject experts.

Statistical techniques applied to analyze the data

In the present study play way instructional strategy is the independent variable and academic achievement is the dependent variable. The academic achievement test score for both the Pre Test and Post Test were recorded in an Excel sheet and later on, was analysed using SPSS. The statistical techniques used in the present study are:

- The Mean
- The Standard deviation &
- Paired t- Test.

Testing of hypotheses:

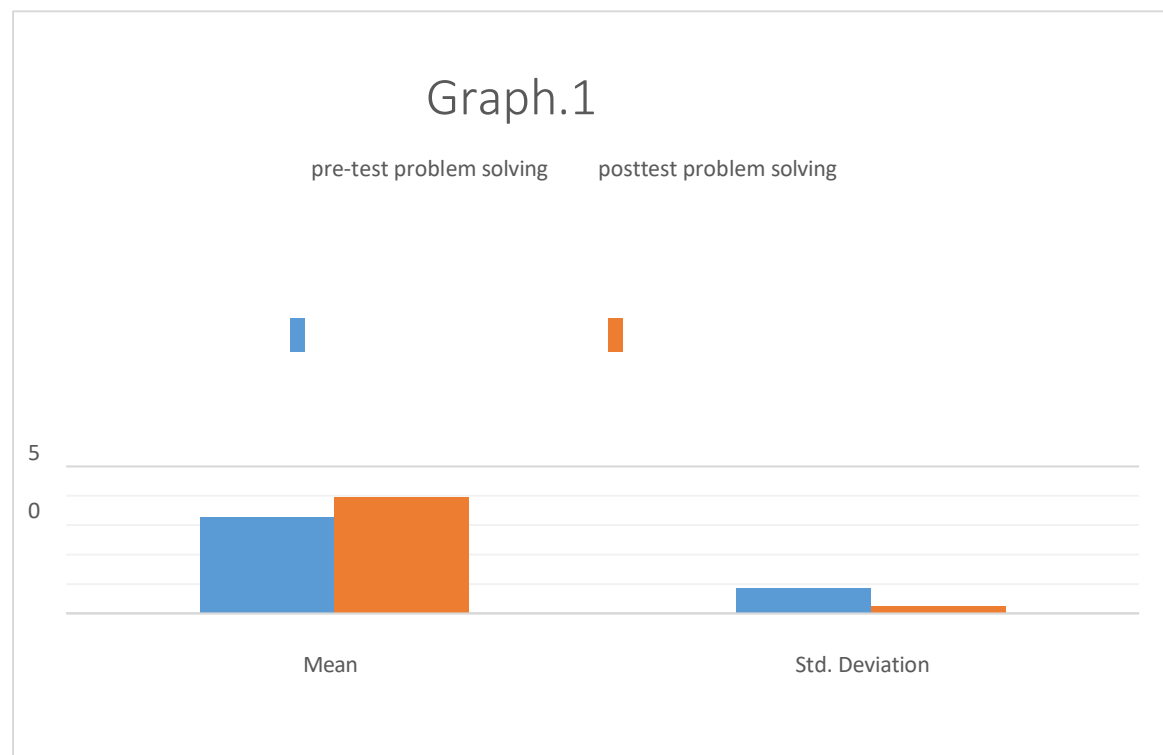
Hypothesis-1: There is a significant difference between the number work scores obtained for problem-solving before and after the intervention using play way instructional strategy.

Table 1 Difference in Mean, Standard Deviation & t value between the pre-test & the post-test scores for Problem Solving.

Description	Size(n)	Mean(m)	SD	t-value	Significance level
Problem Solving					
Pre-test	80	3.27	0.85	7.045	Significant at 0.05 level
Post-test	80	3.93	0.24		

df= 79, t table value= 1.664

Graph 1. Difference in Mean, Standard Deviation between the pre-test and the post-test scores for Problem Solving.



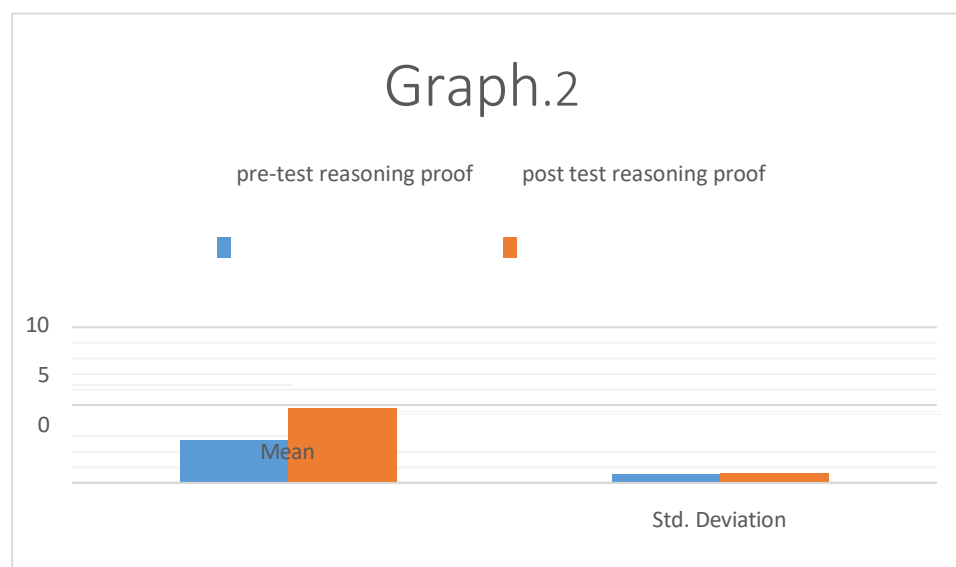
Hypothesis-2: There is a significant difference between the number work scores obtained for reasoning proof before and after the intervention using play way instructional strategy.

Table 2 Difference in Mean, Standard Deviation & t value between the pre-test & the post-test scores for Reasoning Proof.

Description	Size(n)	Mean(m)	SD	t-value	Significance level
Reasoning Proof					
Pre-test	80	2.74	0.53	23.802	Significant at 0.05 level
Post-test	80	4.78	0.61		

df= 79, t table value= 1.664

Graph 2. Difference in Mean and Standard Deviation between the pre-test and the post- test scores for Reasoning proof.



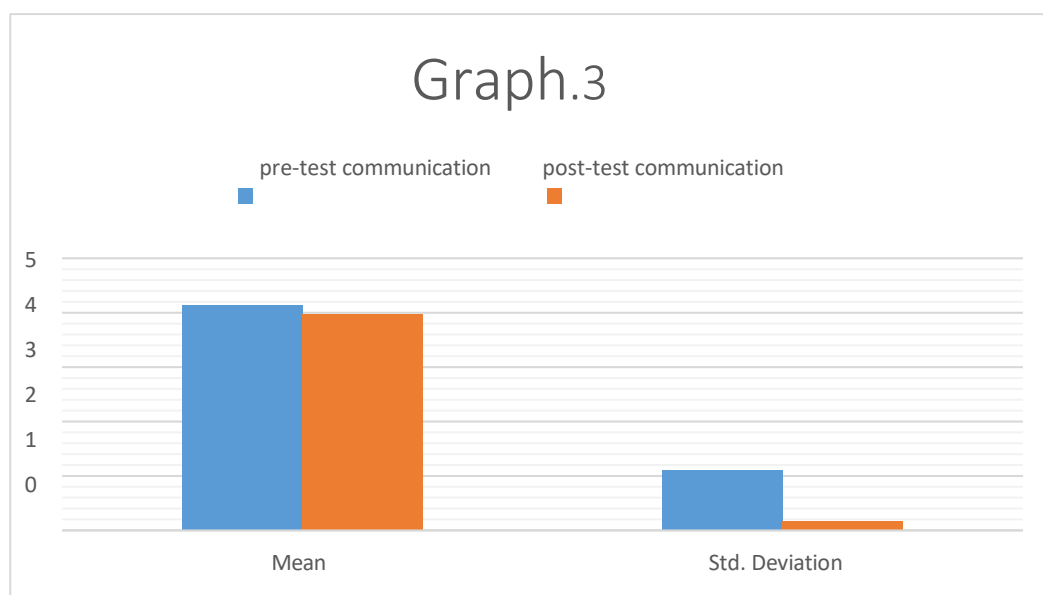
Hypothesis-3: There is a significant difference between the number work scores obtained for communication before and after the intervention using play way instructional strategy.

Table 3 Difference in Mean, Standard Deviation & t value between the pre-test & the post-test scores for Communication.

Description	Size(N)	Mean(M)	SD	t-value	Significance Level
Communication					
Pre-test	80	4.13	1.10	1.337	not significant
					at 0.05 level
Post-test	80	3.96	0.16		

df= 79, t table value= 1.664

Graph 3. Difference in Mean and Standard Deviation between the pre-test and the post test scores for Communication.



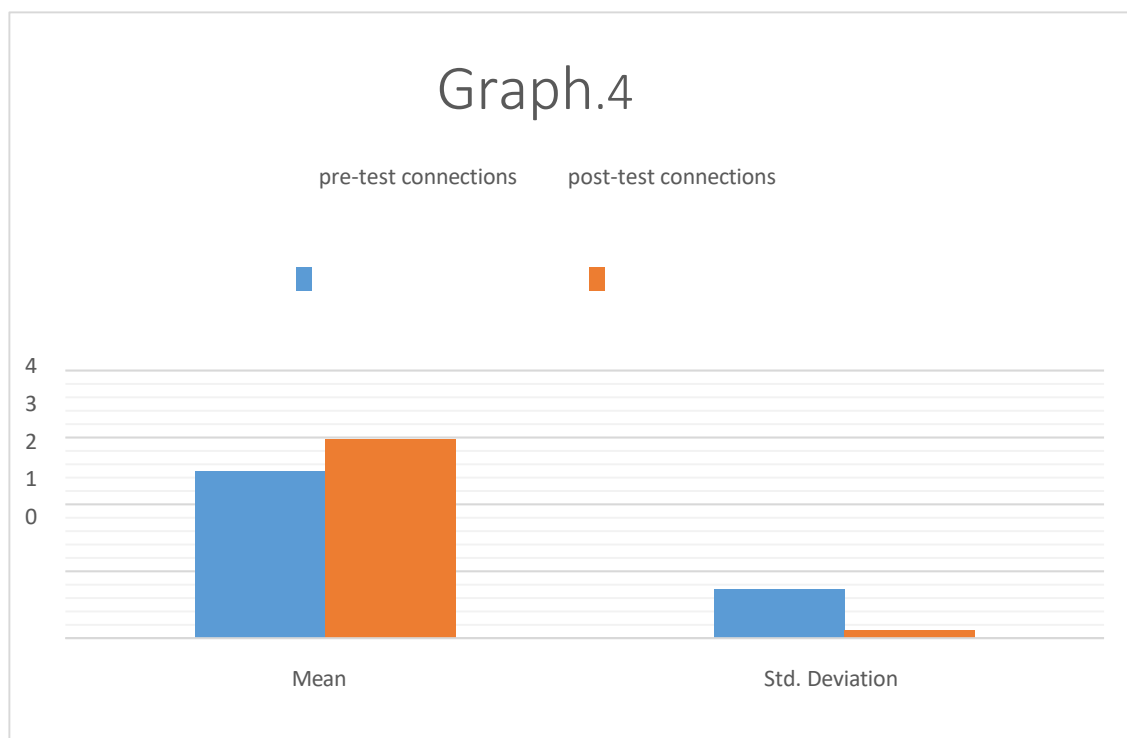
Hypothesis-4: There is a significant difference between the number work scores obtained for establishing connections before and after the intervention using play way instructional strategy.

Table 4 difference in Mean and Standard Deviation between the pre-test & the post-test scores for Connections.

Description	Size(N)	Mean(M)	SD	t-value	Significance Level
Connections					
Pre-test	80	2.50	0.72	5.888	Significant at 0.05 level
Post-test	80	2.98	0.12		

df= 79,t table value= 1.664

Graph .4. Difference in Mean and Standard Deviation between the pre-test and the post-test scores for Connections.



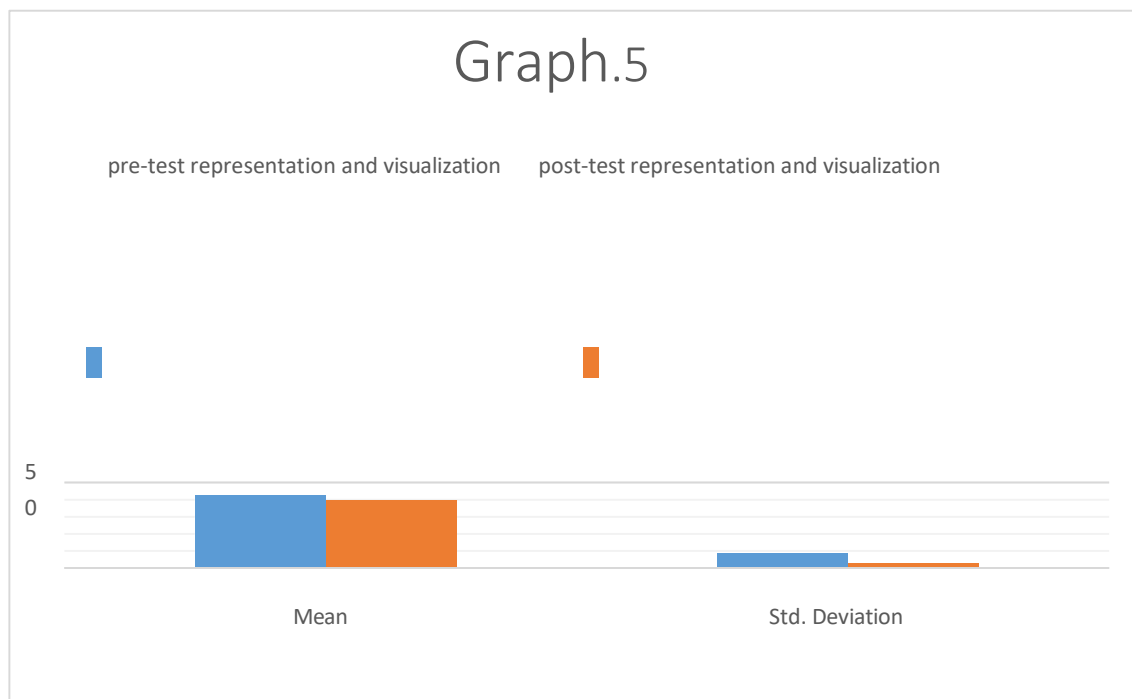
Hypothesis-5: There is a significant difference between the number work scores obtained for Representation and Visualization before and after the intervention using play way instructional strategy.

Table .5 Difference in Mean, Standard Deviation & t value between the pre-test & the post-test scores for Representation and Visualisation.

Description	Size(N)	Mean(M)	SD	t-value	Significance Level
Representation and Visualisation					
Pre-test	80	4.23	0.84	3.222	significant at 0.05 level
Post-test	80	3.93	0.24		

df= 79,t table value= 1.664

Graph 5. Difference in Mean and Standard Deviation between the pre-test and the post-test scores for Representation Visualisation.

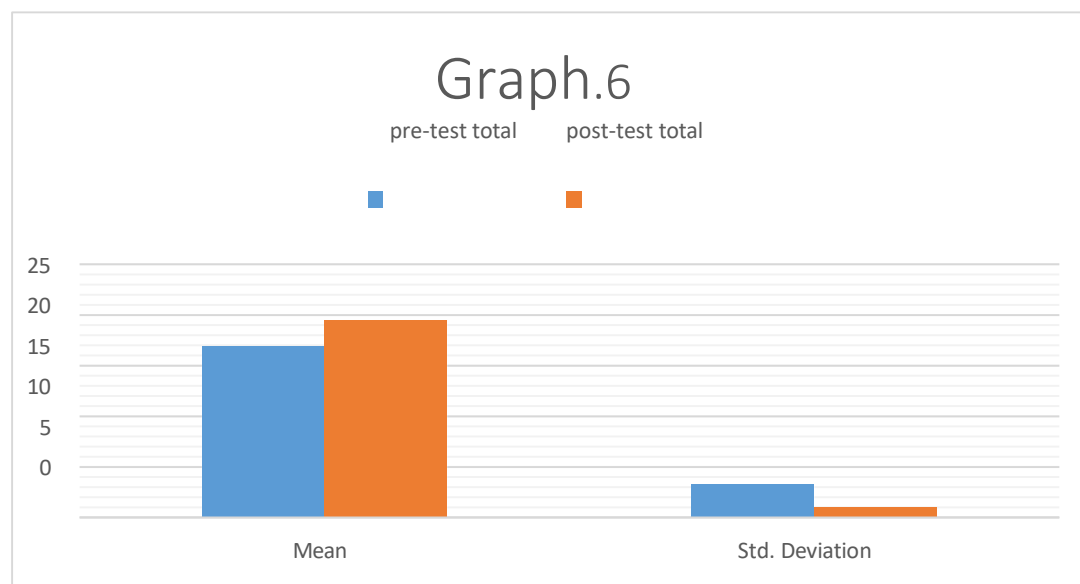


Hypothesis-6: There is a significant difference between the Achievement scores in number work before and after the intervention using play way instructional strategy.

Table 6 Difference in Mean, Standard Deviation & t value between the pre-test & the post-test scores for Achievement in Number work.

Description	Size(n)	Mean(m)	SD	t-value	Significance level
Achievement Scores					
Pre-test	80	16.87	3.31	6.747	Significant at 0.05 level
Post-test	80	19.45	1.04		
					df(79),t-value=1.664

Graph 6 Difference in Mean and Standard Deviation between the pre-test and the post- test scores for Achievement Scores.



Findings and discussion:

There is a significant difference between the number work scores obtained for problem-solving before and after the intervention using play way instructional strategy.

Using Play way instructional strategy, the number work scores obtained for problem solving in the post-test was found to be higher compared to the pre-test scores, which is probably because children learn to solve problems more effectively when the teacher uses play as an instructional strategy. Play way strategies encourage preschoolers to actively engage with the learning material. They can participate in hands-on activities, games, and puzzles that require problem-solving skills. This active engagement promotes critical thinking and helps preschoolers develop problem-solving strategies in number work. The play-way instructional strategy promotes creativity and imagination,

which are crucial for finding innovative solutions to problems. Pre-schoolers approach number work with a fresh perspective, thinking outside the box to develop unique problem-solving approaches. Play way instructional strategies focus on creating a positive learning environment where preschoolers feel safe to take risks and make mistakes. This boosts their confidence in problem-solving and encourages them to persist, even when faced with challenging number work tasks.

Problem-solving skills developed through play way instructional strategies in number work can be transferred and applied to other areas of learning. Preschoolers develop a problem-solving mindset and become better equipped to tackle challenges across various subjects.

- **There is a significant difference between the number work scores obtained for reasoning proof before and after the intervention using play way instructional strategy.** It was found that the mean scores obtained for reasoning proof in the post-test was higher than the pre-test scores. Introducing reasoning and evidence to preschool children can create a strong foundation for their future learning and cognitive development. Although preschoolers may not engage in formal deductive reasoning as older students, they can still benefit from activities that encourage logical thinking. Play way instructional strategies are often more engaging for students, as they involve interactive and enjoyable activities. When students are motivated and interested in the learning process, they are more likely to invest effort and time into understanding the reasoning behind the number work and developing strong proofs. Play way strategies

often involve hands-on activities and real-world problems, which require students to actively participate. This type of active learning helps students develop a deeper understanding of the reasoning required for proofs in number work.

- **There is no significant difference between the number work scores obtained for communication before and after the intervention using play way instructional strategy.**

It was observed that the mean scores obtained for the post-test for communication were lower than the communication scores obtained for the pre-test. Preschoolers are at the beginning stage of learning to interact with teachers and peers. They are still developing their language and communication skills. As such, they may not have the vocabulary or expressive abilities to effectively communicate complex emotions or

engage in open discussions about their inner feelings. Play way instructional strategies often prioritize play, exploration, and hands-on activities as the primary mode of learning. While these activities provide valuable learning experiences, they may not specifically target or provide opportunities for students to discuss their inner feelings or engage in open communication. Preschool students may have limited language proficiency, which can impact their ability to express their inner feelings and engage in meaningful discussions. They may not have the necessary language skills or vocabulary to articulate their emotions or engage in deep conversations. The classroom environment may not always foster open discussions and communication of inner feelings. Factors such as time constraints, group size, and teacher-student dynamics can restrict the opportunities for students to freely express themselves and engage in conversations about their inner feelings. Play way instructional strategies often prioritize the development of cognitive skills, creativity, and problem-solving through play and exploration. While these activities are essential for holistic development, they may not explicitly address or prioritize discussions and communication of inner feelings.

However, it is important to note that even though the play way instructional strategy may not directly address communication of inner feelings and open discussions, it can still indirectly contribute to the development of communication skills. Play-based activities can foster social interactions, cooperation, and turn-taking, which are foundations for effective communication. Furthermore, creating a nurturing and supportive classroom environment that encourages students to express themselves can positively impact their ability to communicate

their inner feelings over time.

- **There is a significant difference between the number work scores obtained for establishing connections before and after the intervention using play way instructional strategy.**

It was observed that the scores obtained for the post-test for establishing connections were higher than those obtained in the pre-test. Play way instructional strategies often involve hands-on activities, games, and simulations that encourage students to actively engage with the material. When students are actively involved in their own learning, they are more likely to make connections and understand the concept of establishing connections in number work. Play way instructional strategies often use concrete objects or manipulatives to help students visualize and understand abstract concepts. For example, using blocks or counters to represent numbers and operations can help students see the relationships and connections between numbers. By making connections between the abstract concept of numbers and their practical use in everyday life, students can see the relevance and importance of establishing connections in number work.

- **There is a significant difference between the number work scores obtained for Representation and Visualization before and after the intervention using play way instructional strategy.**

The scores obtained in the post-test for Representation and visualization were higher than the scores obtained in the pre-test. Play-based strategies engage children in hands-on activities, allowing them to manipulate objects and materials. This active learning promotes better understanding and retention of concepts. Through play, children can explore and experiment with different ideas, encouraging representation and visualization skills. Play way strategies help them understand abstract concepts by directly experiencing and visualizing them in a concrete context. Play-based activities often involve the use of multiple senses, such as touch, sight, hearing, and movement. This multi-sensory engagement reinforces learning and helps children create mental images. For example, playing with blocks allows children to visualize spatial relationships and shapes.

Overall, the play way instructional strategy provided a conducive environment for developing and enhancing representation and visualization skills among preschool students by promoting active, experiential, and personalized learning experiences.

- **There is a significant difference between the Achievement scores in number work before and after the intervention using play way instructional strategy.**

Post-test scholastic achievement scores in number work among Preschool students was found to be higher than pre-test achievement scores. This may be due to the fact that Play way instructional strategies encourage active participation and engagement from students. Play way strategies often involve the use of various senses, such as sight, touch, and hearing. By incorporating different sensory experiences, these strategies helped children better understand abstract concepts related to numbers and arithmetic.

Play way strategies provide opportunities for learning in real-life contexts. By using play scenarios, games, and practical examples, students can better understand how numbers work and how they relate to their everyday lives. Play way instructional strategies allow for individualized instruction, allowing students to progress at their own pace.

This personalized approach ensures that each child receives the appropriate support and challenges needed to enhance their number work skills.

Educational implications:

The following are the educational implication of the present study.

- In this study, we draw attention to the meaning of playful teaching strategy which helps students learn in a relaxed way and enjoy learning. This helps the curriculum designer to set goals, monitor and evaluate his/her academic progress.
- Achieving Academic standards contribute to the overall development of the students. Academic standards in Mathematics include problem **solving** which helps the student solve problems and plan accordingly, **reasoning** which helps students develop logical thinking, **communication** helps students express their inner feelings and discuss freely without hesitation, **Connections** helps students make connections between what they are learning in class and at home **Representation and visualization** helps students develop their memory and the image to be remembered by students for a long time.
- The curriculum should include a play-based teaching strategy that awakens and develops the cognitive level of students.
- play-based method should be developed among school children to help them learn effectively, perform in the classroom and improve their academic performance

accordingly.

- Curriculum designers should include activities based on academic standards such as problem solving, reasoning proof, communication, making connections, and visualizing a presentation.
- Using play-based teaching strategies allows students to understand and transfer their learning to different situations, which ultimately improves their learning. Therefore, students should be encouraged to learn subjects using play-based teaching strategies that help them improve knowledge management, plan and monitor activities to achieve goals, understand mistakes made in evaluating the learning. Teaching using the play way method improves students' academic performance and makes them proficient learners.

Limitations of the study:

The limitation of the present study are as follows:

- Due to the constraints of time and resources a sample of eighty preschool students from one school was taken for the study which restricted the scope of generalization.
- The data was delimited to Preschool students in Koratla, Jagtial district of Telangana state.
- The time allotted for the research study is limited.

Scope for further study:

- The sample taken for the study is only 80 pre-school students from three different sections from Goutham high school of Jagtial district. If the study is carried out on a larger sample the results would be more contextually relevant and conventionally accepted.
- Due to time constraints the researcher had to collect data from one part of Jagtial District. If there was more time allotted for the research study, it could have been more exhaustive.

The following are some of the suggested research problems for future research.

- The study could also focus on structured & unstructured play among primary students.
- The present study could be undertaken for a larger sample from various states in India.

Conclusion:

The results of the study showed that there is a difference in scholastic achievement of preschool students in number work before & after intervention. The researcher found that if the teacher used play way instructional strategy, children learn more effectively. When students associate number work with fun and playfulness, they are more motivated to explore and engage with the concepts, leading to higher achievement. Through hands-on activities, manipulatives, and group play, students can develop a love for learning, which can positively impact their understanding of number work.

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Integrating Arts in Teacher Education

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ABSTRACT

Art fosters expression, creativity, exploration, and critical thinking. With evolving educational paradigms, aesthetic expression now runs parallel to academic skills. The Art Integrated Learning Model emphasizes exponential learning through and with the arts. In an art-integrated curriculum, art becomes a medium for teaching and understanding concepts across subjects. NEP 2020 reinforces this approach, advocating learning through expression. This experimental study documents St. Ann's College of Education's efforts to integrate art into the B.Ed. curriculum. Initially conceived for NAAC inspection, the initiative led to the establishment of 'Kalakriti,' a dedicated art room where each wall narrated a story. Students, mentored by faculty, created murals reflecting the College's vision—Pedagogy of the Heart to Serve with Love. A brochure and a Hindi poem were also produced as artistic narratives. A three-week intervention assessed the impact of art-integrated learning on recall ability and student perceptions. Faculty observed attitudinal changes in student artists, who expressed enthusiasm for integrating art into their teaching to make learning joyful. Alternative career pathways emerged, including fine arts pedagogy, personalized learning spaces, and storytelling. The Kalakriti intervention demonstrated how art fosters imagination, creativity, and personal interpretation, offering diverse learning modes. An art-infused curriculum holds immense potential to enhance teacher education and cultivate creative educators at all levels.

Keywords: *Art Integrated Learning, Kalakriti, Pedagogy of the Art*

Introduction

Generational evolution is closely linked to the services provided to meet changing consumer needs. In education, market competition drives innovation, compelling institutions to develop

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research-based teaching and learning approaches that help students acquire, apply, and create meaningful learning experiences. This shift moves education beyond the mere attainment of qualifications toward holistic intellectual growth. As a result, teacher education curricula must evolve to address this demand-driven phenomenon. The National Education Policy (NEP) 2020 strongly advocates student-centered learning through frameworks, concepts, and techniques that develop 21st-century skills. One such promising and evidence-based approach is Art-Integrated Learning (AIL), which bridges education and culture to enhance learning outcomes.

The Pedagogy of the Heart embodies a transformative educational philosophy, fostering continuous dialogue among educators, researchers, teachers, administrators, students, families, lawmakers, and communities. It seeks to empower marginalized and vulnerable groups through education, enabling them to achieve self-reliance and contribute to an equitable society. NEP 2020 aligns with this vision, defining art integration as a “cross-curricular pedagogical approach that utilizes various aspects and forms of art and culture as the basis for the learning of concepts across subjects.” This approach fosters experiential and joyful learning, deeply embedding Indian ethos within the curriculum. Instead of treating art as a separate discipline, art integration allows students to engage with concepts through illustration, experimentation, and demonstration. This process activates multiple domains—cognitive, socio-emotional, behavioural, and psychomotor—ensuring a deeper and more meaningful learning experience.

Empirical research highlights several benefits of art-integrated learning. It encourages teachers to develop innovative instructional designs that integrate art into subject-specific content. It enables students to use art forms to achieve academic objectives by linking artistic expression with core subjects. Beyond rote memorization, art-integrated programs foster deeper learning, with evidence showing that students engaged in such programs score higher on standardized tests than those following conventional curricula. Moreover, it promotes active student participation in both artistic and subject-specific content (Biscoe & Wilson, 2015). Art-integrated learning enhances student interest and self-efficacy, fostering knowledge building through diverse artistic learning environments. It also encourages engagement in classroom discourse, such as poetry, visual arts, and creative expression, leading to improved knowledge retention (Doyle et al., 2014; Gregory et al., 2011). Additionally, students take ownership of their learning, exercising autonomy in selecting art forms and materials for content presentation (Lynch, 2007).

The research on art-integrated learning proved promising, offering a cost-effective and time-efficient approach. Inspired by these findings and the desire to experiment with and showcase an art-integrated project, *Kalakriti* emerged as a collaborative initiative involving student-teacher artists, alumni, faculty, and management.

This study aims to address the existing gap in research by assessing the impact of an art-integrated intervention on pre-service B.Ed. teachers. It hypothesizes that there is a significant increase in student retention through the Art-Integrated Intervention that students are more inclined to incorporate art-integrated activities into their teaching practice post-intervention, and that faculty mentoring fosters excellence in students' artistic and cognitive growth.

Review of related literature

The literature collectively underscores the significance of AIL in fostering deeper conceptual understanding, enhancing teacher preparedness, and cultivating 21st-century skills among students. However, challenges such as insufficient training, inadequate institutional support, and resource limitations continue to hinder its full integration into mainstream education.

Theoretical Foundations of Arts-Integrated Learning (AIL)

The integration of arts into education has been widely studied as an approach that fosters holistic learning. Heath (2014) argues that learning through the arts is foundational in enhancing students' cognitive and social development. The study highlights that arts-based learning environments encourage critical thinking, creativity, and problem-solving, making them an essential pedagogical tool in modern education. Doyle, Huie Hofstetter, Kendig, and Strick (2014) support this claim, emphasizing that an integrated learning approach allows students to engage with multiple disciplines simultaneously, reinforcing deeper conceptual understanding.

AIL in Teacher Education: Teacher preparation plays a critical role in the successful implementation of AIL in classrooms. Hipp and Dowell (2019) examine the challenges and supports faced by preservice teachers when integrating arts into their teaching practice. Their findings suggest that while many educators recognize the benefits of AIL, they often lack the training and institutional support required for its effective implementation. This underscores the necessity for structured training programs within teacher education curricula to prepare future educators for art-integrated instruction. Maneen (2016) expands on this by illustrating

how AIL fosters 21st-century skills—critical thinking, creativity, communication, and collaboration—among educators, ultimately benefiting their instructional strategies.

Impact of AIL on Conceptual Understanding and Cognitive Development: AIL has been shown to enhance students' academic performance and engagement with subject matter. Mohalik and Basu (2020) provide empirical evidence demonstrating that AIL significantly improves conceptual understanding, particularly in subjects like geography. Their study indicates that integrating artistic elements into learning activities increases students' recall ability and long-term retention of knowledge. Doyle et al. (2014) similarly found that students exposed to integrated learning programs performed better in assessments compared to those in traditional learning settings, supporting the argument for a cross-disciplinary, immersive learning experience.

Challenges in Implementing AIL: Despite its advantages, implementing AIL faces several obstacles, particularly in resource allocation and institutional adoption. Hipp and Dowell (2019) note that many preservice teachers struggle with adapting AIL due to limited training and rigid school curricula. Additionally, Maneen (2016) highlights that many educational institutions lack dedicated spaces and materials for arts-integrated instruction, which hampers its widespread application. This aligns with Mohalik and Basu's (2020) assertion that institutional support is critical for successfully embedding AIL in educational settings.

Research questions

A review of past research revealed limited documentation of art-integrated experiments in teacher education. This raises critical questions such as:

1. How does the presence of a dedicated art space influence B.Ed. student teachers' adoption of art-integrated pedagogy?
2. What is the impact of hands-on art-integrated teaching experiences on student teachers' pedagogical practices and engagement?
3. How do student teachers perceive and integrate diverse pedagogical approaches, including art-integrated strategies, into their teaching?
4. In what ways does faculty-student mentoring influence research engagement and pedagogical skill development in student teachers?

Objectives of the study

1. To adhere to the National Educational Policy 2020 guidelines of incorporating an art- integrated learning model.
2. To identify a space that encourages student teachers to promote the use of art- integrated pedagogy in the B.Ed. curriculum.
3. To provide hands-on experience in art-integrated teaching and learning.
4. To expose student teachers to various pedagogies and encourage them to incorporate it into their teaching practices.
5. To develop a mentoring program that pairs faculty and students to delve into research.

Methodology

The study adopted a mixed research design, combining both quantitative and qualitative research methods to provide actionable effects through this case study. The quantitative approach included (1) an art-integrated intervention and a content pre-test and post-test covering the college's Pedagogy of the Heart for all participants; (2) perceptions of the artist participants on the motifs of the Pedagogy of the Heart as well as their personal growth in terms of artwork and creativity. The qualitative approach included faculty feedback on artist students' attitudes toward self-learning, creativity, and contextual learning as a result of faculty mentoring.

Variables of the Study

The variables differed depending on the modalities being tested. For the quantitative modalities, all students were assessed on a content assessment to test their knowledge retention ability. The independent variable in all modalities was the art-integrated intervention, while the dependent variables differed: for the content assessment, the dependent variable was student retention, and for ascertaining the perceptions of the student artists who worked on the motifs, the dependent variable was their perceptions of art-integrated pedagogy and ensuing attitude change.

Population and Sample

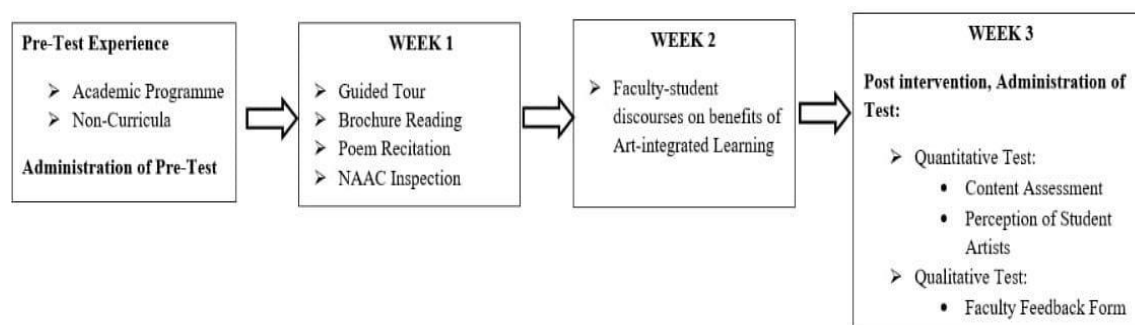
The population comprised all B.Ed. pre-service teachers enrolled in the 2021–23 and 2022–24 batches at St. Ann's College of Education, totalling 58 students. A purposive sample of 10 student artists was selected for the qualitative perception study, while all 58 students

participated in the quantitative pre-test and post-test assessments.

Art Integrated Learning Intervention The intervention lasted for a duration of 21 days as is explicit in the flow chart (Fig 1) below:

Figure 1

The Art-Integrated Intervention Flowchart



The pre-intervention commenced with aspiring teachers being oriented on the Pedagogy of the Heart, which required students to serve with love—serving with care and compassion. Instructions, both theoretical and practical, on this concept were integrated into the B.Ed. curriculum, playing out in methodology classes as well as co-curricular events, e.g., morning assembly, Founders' Day, Human Rights/AIDS awareness, etc. Students learned about the Pedagogy of the Heart through various approaches but not through the art-integrated route. Thereafter, students were administered the pre-test to assess their level of knowledge retention. The assessment was designed to examine their recall and remembering capacity of the taught content. It was administered to all the students of the B.Ed. programme.

In the first week of the intervention, students were exposed to a talk, a guided tour of the art room, a reading of the brochure on Kalakriti, and a recitation of a Hindi poem on the motifs. The student artists were able to elucidate their learning experiences coherently to the students, thereby incorporating cooperative and collaborative learning among them. The brochure curated on Kalakriti, detailing the description of each wall, was read aloud to the students. They were also exposed to a Hindi poem that narrated the contents of each wall in a well-paced manner, appealing to the listener's emotions. This bilingual approach to teaching allowed students to experience the content in different ways, accommodating their various learning styles. Students were prepped for the NAAC inspection. During the NAAC inspection, they were able to effectively interpret the motifs and the emotions/messages conveyed.

In the second week, the faculty mentored students through classroom discourses, highlighting

the various benefits of the art-integrated approach and encouraging student teachers to imbibe the Pedagogy of the Heart through the Pedagogy of the Art.

In the third week, post the art-integrated intervention, the student teachers were presented with a post-test, administered online to gauge whether there was a change in content retention levels after the intervention. The student artists who worked on the motifs were subject to an additional survey that captured their perceptions of art-integrated pedagogy after the intervention to assess attitudinal change in tandem with personal and cognitive growth.

The faculty involved in planning and designing the intervention, including mentoring the student artists, were also administered a feedback form devised to capture their observations on the attitudinal and other changes in them, from orientation to task completion.

Tools designed

1. Narratives

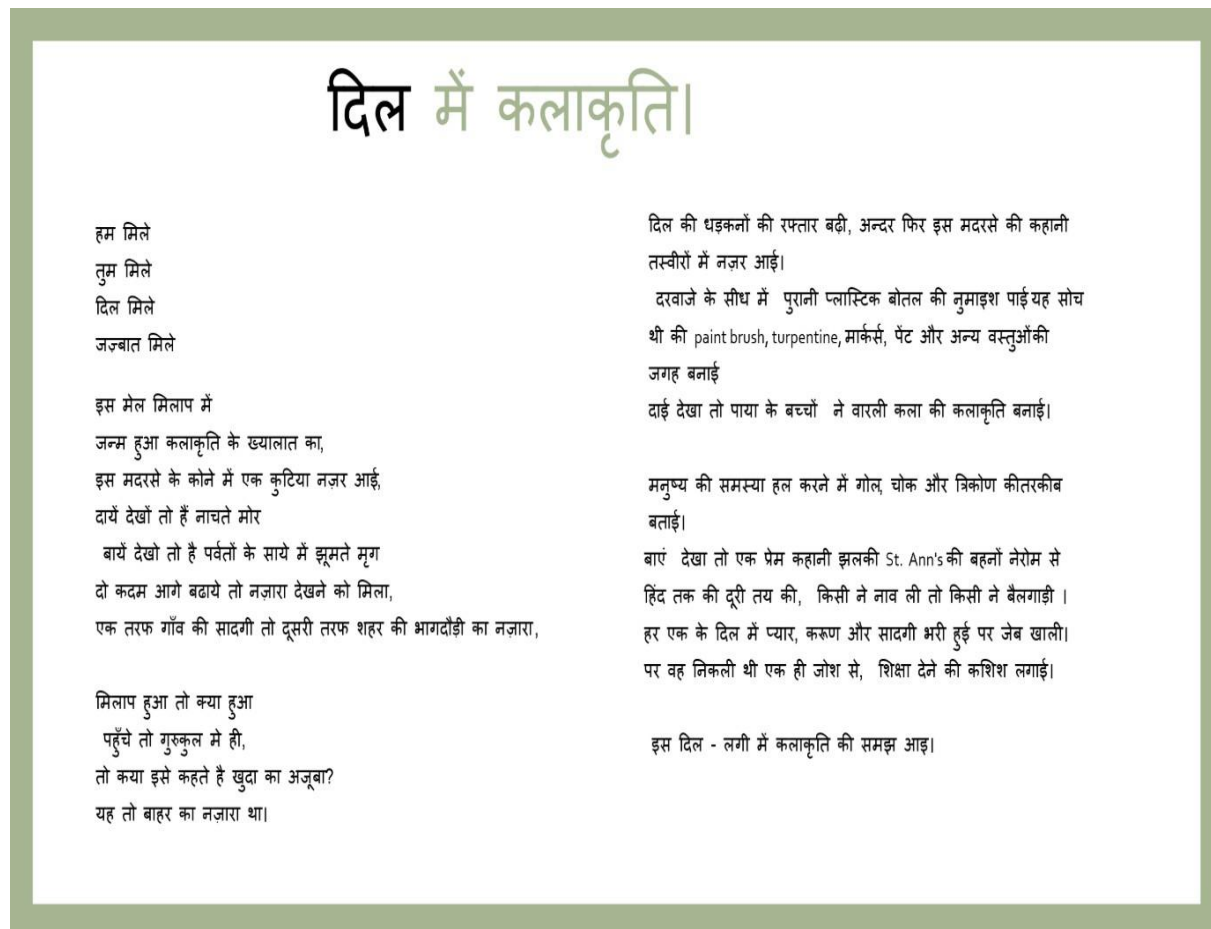
1A. Art-Integrated Teaching and Learning [Brochure]. See Figure 2.

Figure 2

Art-Integrated Teaching and Learning [Brochure].



1B. Art-Integrated Teaching and Learning [Poem]. See Figure 3.

Figure 3*Art-Integrated Teaching and Learning [Poem].*

1. Pretest Assessment & Post Test – Recall Test
2. Questionnaire to capture the perceptions of the artists on art-integrated pedagogy.
3. Questionnaire Faculty Mentoring Feedback.

Statistical Test

The quantitative data on student recall ability was analysed using descriptive statistics and inferential statistics (paired 't'-tests). Data on student artists' perceptions were analysed, and percentages were obtained.

The qualitative data were analysed using narrative analysis and interpretation was derived from the meaning associated with the words used.

Findings and Discussion

A paired samples t-test was conducted to determine the effect of art-integrated learning on a content test score covering the topic “Pedagogy of the Heart”. The statistical values are presented in Table 1 below.

Table 1

Paired Samples t-Test Results for the Effect of Art-Integrated Learning on Content Test Scores

Measure	Mean (M)	Standard Deviation (SD)	t-value	df	p-value
Pre-Intervention Score	7.88	1.44	24.59	57	< .001
Post-Intervention Score	14.24	1.48			

The results indicate a significant difference between the test score before the intervention ($M=7.88$; $SD=1.44$) and the test score after the intervention ($M=14.24$; $SD=1.48$); [$t(57) = 24.59$, $p < .001$]. From the result, it is evident that art-integrated learning is promising for long-term retention. This finding is commensurate with Basu and Mohalik's (2020) inferential statistics that AIL significantly increased the conceptual understanding recall ability of students.

Student artists' perceptions were obtained through a questionnaire designed exclusively to obtain data from student artists on art-integrated learning. The instrument consisted of 10 questions using a 5-point Likert Scale (5=Strongly Agree, 4=Agree, 3=Undecided; 2=Disagree; and 1= Strongly Disagree). Participants' responses are tabulated in table 2.

Table 2*Survey on Artists Perceptions on the Art-Integrated Pedagogy*

S. No	Questions	Strongly Agree (%)	Agree (%)
1.	When you notice the Kalakriti room, does it immediately bring to mind the story of each wall?	90%	10%
2.	Would you apply the Art Integrated Learning model in your teaching?	90%	10%
3.	Could your language abilities have been enhanced as a result of working on wall art?	50%	50%
4.	Were your critical thinking abilities improved by incorporating visual images into various concepts during the process?	60%	40%
5.	Post this exercise, do you attempt to think in divergent ways to transact knowledge and apply it in your teaching practices?	70%	30%
6.	Did the process contribute to improving your ability to communicate and collaborate with others in a team setting?	90%	10%
7.	Did Kalakriti inspire others to utilize the space for deep and creative thinking?	90%	10%
8.	Has working on the wall improved your skills as an artist?	10%	0%
9.	How has your sense of competence as an artist developed?	80%	20%
10.	Post this, are you motivated to create an art-integrated learning space for Children with Special Needs?	80%	20%

(n=10; purposive sample of student artists)

The responses were positive with all participants either strongly agreeing (90%) or agreeing (10%) that they were more inclined to include art-integrated activities into their teaching practice post-intervention. It was apparent that the AIL intervention had a positive impact on various aspects of academic, cognitive, emotional, and aesthetic development. The results corroborate the findings by Doyle et al. (2014) & Lynch (2007) that AIL propels students with an artistic inclination towards excellence in aesthetic expressions.

As a result of the faculty mentoring, faculty were asked to provide their input on student artists' behaviour and attitudes throughout the AIL intervention. Their feedback was analysed qualitatively. Initially, the faculty observed considerable confusion and concern among the

student artists. They appeared hesitant, issues such as accuracy, size of the drawings and the shape of the figurines seemed to dominate the deliberations. After working closely with the faculty, the students' focus shifted to accuracy, capturing the essence, and expression of each of the assigned murals with confidence. As time progressed, the fear of making mistakes subsided into the background and the thrust of the student efforts was on aspects such as color, strokes, an art form, and aesthetics. Nearing completion, student artists assumed control proposing qualitative changes that made the murals come alive. Students bonded with their peers, shared experiences, made task-related suggestions, assisted one other, and counseled other students to take up art-related tasks.

Conclusion

The benefits of AIL cannot be underestimated. Integrating AIL into the curriculum and across subjects enhances multiple intelligences, cognitive and socio-economic skills through aesthetic expressions. There is a teacher in all of us, but teachers need professional training to develop an individualized teaching style integrated with a triangulation of innovative teaching approaches that animates their students into action-packed learning experiences culminating in holistic fruition. Students should not run after employers; rather, they must be invited and cajoled into taking up desirable employment. This can only happen if teacher education institutes integrate and implement AIL in their curriculum, pedagogies, and internship provisions. AIL-trained teachers will be able to lend themselves to achieving academic excellence in the long-term learning agenda.

B.Ed. institutions must comply with the NCERT and NEP 2020 mandates on AIL. Institutions must make a conscious effort to establish a separate dedicated room for all forms of art. A budget must be set aside for the regular procurement of materials and equipment to facilitate the implementation of art-related teaching and learning. Art-integrated teaching-learning approaches must be weaved into the curriculum and implemented through teacher education programs. Student teachers must be given art training and provided with opportunities to showcase their work. Excursions to sites of esthetic interest must be arranged. Students must be encouraged to express their creative nature. Continuous professional development must be initiated through value-added courses. Scholarships for performing arts should be established to attract the correct talent pool.

The B.Ed. curriculum should be tailor-made with the NEP 2020 guidelines that emphasize the need for teacher training programs to incorporate art-integrated learning into their curricula.

Student teachers at the integrated B.Ed. level should be given immense training sessions and be provided with hands-on experience on how to integrate art with their specific subject content. The cooperating schools that partner with the B.Ed. colleges should allow and give student teachers complete autonomy to implement such pedagogical approaches in the classroom, thereby making it a regular practice in the classrooms ahead.

At the school level, there is a need to educate and create awareness about the benefits of the art-integrated learning model in schools. Teacher training workshops and seminars should be conducted at participating schools to promote the AIL model. They should be encouraged to teach through this approach for a deeper understanding of the concept. The management, faculty, and parents at school may be hesitant to employ this model in the classroom due to the paucity of time and availability of resources. But, if all the stakeholders partake in the process, cognitive growth among the students will be seen rather than passive recipients of knowledge. Policymakers play a crucial role in promoting and supporting art-integrated learning by enacting laws and policies that prioritize AIL and ensure it is given equal importance in the curriculum. They should make deliberate efforts to work with local arts organizations to promote partnerships between schools and art organizations. Giving local and small-scale artists a platform to showcase their creativity and working in close associations with educators to develop creative instructional plans. It opens up an avenue for artists to generate income and opens employment opportunities for budding artists as well as teachers.

Limitations and suggestions for future research

While this study highlights the potential of AIL, its implementation faces several challenges. The hesitation of school management, faculty, and parents due to time constraints and limited resources remains a significant barrier. Additionally, there is a lack of adequate teacher training programs that focus on AIL, making it difficult for educators to seamlessly integrate art into their pedagogy. The success of AIL also depends on policymakers' support in prioritizing this approach within the national curriculum. Furthermore, without proper funding, establishing dedicated art spaces, procuring materials, and arranging necessary excursions become challenging.

One limitation of this study was its case study approach with a small sample size, restricting the findings to the perceptions of artist students. Future research should explore a broader and more diverse sample, including non-artist pre-service teachers, to gain a more comprehensive understanding of AIL's impact.

It is hoped that this study will invigorate art-integrated teaching and learning. More research on the benefits of AIL as well as its implementation should be undertaken. Experimental studies with art-integrated interventions must be carried out with a larger cohort of pre-service teachers to corroborate and consolidate the findings of this study. With the NEP 2020 guidelines being implemented nationwide, it is proposed that integrated professional degrees will benefit from an AIL curriculum to master subject content and beyond. The results of this study are also promising for creating diversified learning aids for children with special needs.

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Developing Pre-service teachers' Content knowledge and Pedagogical Vision for teaching Social Sciences through Lesson Research

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ABSTRACT

Teaching involves the use of a wide body of knowledge about the subject being taught and also knowledge about the important techniques and methods to teach the content. The purpose of the present study is to examine the effectiveness of lesson research strategy in developing content knowledge, analyzing the content from a pedagogical perspective and presenting it with ICT mediation. Subsequently, the objectives of the study were to develop content knowledge in social sciences in pre- service teachers, to develop their ability to analyze it from a pedagogical perspective and present it using technology. For the study, a single group pre-test and post-test design was used. Secondary school pre-service teachers of social sciences were selected under purposeful sampling. Lesson Research strategy was used to achieve the objectives. Under lesson research, students did research of the given lesson under the given questions, wrote assignment for the questions and prepared PPT with content, images, videos and questions and presented the content to peer group. Pre-test and post-tests were conducted on content, pedagogical vision and presentation skill. Written assignments and seminar presentation with PPT were assessed under performance based assessment to find out the effectiveness of strategy. Data collected was statistically analyzed with SPSS and found that lesson research strategy was equally effective on pre-service teachers with teaching experience (1to 3 years) in primary school and pre-service teachers without any teaching experience. The lesson research is useful to develop content knowledge and pedagogical vision in prospective teachers.

Keywords: *Lesson research, content knowledge, pedagogical vision*

Introduction

According to the Kothari commission (1964-66) "Destiny of India is shaped in its classrooms". Teachers are the architects of the future of India. Quality school education depends on the quality of teachers. Quality teachers are prepared in teacher education institutions. Consequently, pre-service training requires quality curriculum, effective classroom

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transactions and practical knowledge of the subject. Role of teacher educators in providing quality training is imperative. From the beginning of the course, they are required to follow interactive and innovative strategies in order to develop professional qualities and competencies in pre-service teachers. Content competency is one of the competencies to be developed in the trainees.

Theoretical Background of the Study

Lee Shulman (1986) in his paper “Knowledge and Teaching: Foundations of the New Reform” emphasized the importance of content knowledge and pedagogical reasoning. Teachers must know the management of ideas in the classroom discourse in order to monitor students’ thinking. According to Shulman, to teach is first to understand. Teachers are expected to understand the subject to be taught. In addition to this, teachers must have a pedagogical vision. Strong subject knowledge is a pre-requisite of effective teaching. (Dr. Jack Wiktor Brant). Research studies revealed that strong content knowledge and analyzing it from a pedagogical perspective is necessary for effective teaching. Content knowledge includes the knowledge of the nature of the subject to be taught in schools, facts, concepts, theories and principles in the subject, identifying the relationship between the ideas within the subject and in other disciplines. Moreover, teachers must have pedagogical vision. It is the capacity to analyze the content from a pedagogical perspective. It is thinking about the objectives of teaching the subject, importance of teaching a topic to students, thinking about questions to be asked, examples to be given, activities and teaching materials to be used in order to develop conceptual understanding in students. Pedagogical vision enables teachers to plan and take actions for successful teaching. Consequently, teacher training programs should develop content competency and pedagogical vision in prospective teachers.

In India, the National Council of Teacher Education has identified ten competencies which teachers should have. Content competency is one of the ten competencies. In this context, the National Council of Teacher Education in India focused on these competencies in the teacher education curriculum framework. According to constructivism, learning is a process of construction of knowledge. Teaching is facilitating the construction of knowledge. Consequently, to facilitate students in constructing knowledge, teachers should have sound subject knowledge. It enables teachers to guide the students to explore information, ask thought provoking questions and remove their misconceptions and misunderstanding in framing the knowledge.

Significance of the study

Teaching social sciences occupies a significant place in Indian school curriculum. According to NCF-2005 teaching and learning social sciences is important because it enables the children to understand the society in which they live, to learn how society is structured, managed and governed. And also it enables the children to appreciate the values enshrined in the Indian constitution and the building of a socialist, secular and democratic society. So social sciences encompass diverse concerns of society and include a wide range of content drawn from the disciplines of history, geography, political science, economics and sociology to develop the knowledge, skills and values in restructuring the society.

Firstly, Knowledge of the interaction of man with his physical and social environment is very important for every individual in order to adjust with the physical and social environment. A good citizen must acquire a certain amount of factual information. Because, without knowledge of concepts, facts and events in social sciences, developing thinking and critical thinking is not possible. Moreover, modern society is facing many social and environmental problems. Without proper thinking, problems cannot be solved. Knowledge is also necessary to develop proper attitude and sensitivity in students. Therefore, learners should have broad knowledge of issues of socio-political life and physical environment. Teaching basic concepts, facts, terms and principles in social science enable the children to understand the society in which they live. Therefore, teachers should have sound knowledge of the content of economics, political science, geography and history. Then only they can achieve the aims and objectives of teaching social sciences. So, this study is significant in developing content knowledge in social science pre-service teachers. Not only this, but also they must analyze the content from a teaching point of view so that they transact to teaching social sciences accordingly.

Secondly, social science pre-service teachers were not exposed to content knowledge during their graduation level. Many students are from commerce background. Students are not aware of the content of school social science subject. So, through lesson research, the researcher tried to develop content knowledge, pedagogical vision and presentation skills in prospective teachers.

Finally, one of the course objectives of pedagogy of subjects is to develop content competency, pedagogical vision and representing it using ICT in pre-service teachers. Subsequently lesson research strategy was designed and implemented.

Lesson Research

Lesson Research is an innovative strategy in which B.Ed. trainees are required to study the lesson of the social science school textbook to identify the important concepts, terms and principles and also identify the relationship in the different ideas of a lesson. Moreover, they have to analyze the content of the lesson from a pedagogical point of view in the light of given questions. It is also necessary to present their pedagogical understanding using technology to peer group.

Research questions

- a) Is lesson research effective in developing content knowledge in social science pre-service teachers?
- b) Is lesson research effective in developing pedagogical vision in prospective teachers of social sciences?
- c) Is lesson research effective in developing presentation skills using technology in prospective teachers?

Objectives

- 1. To examine the effectiveness of lesson research in developing content knowledge in pre-service teachers of social science
- 2. To examine the effectiveness of lesson research in developing pedagogical vision in pre-service teachers of social science
- 3. To find out the effectiveness of lesson research in developing presentation skills in social science pre-service teachers.

Variables

Independent variable - In-service teachers with teaching experience (1 to 3 years) in primary school and without teaching experience

Dependent variable - Effectiveness of Lesson research strategy

Null Hypotheses

- 1. Lesson research is not effective in developing content knowledge in social science pre-service teachers with teaching experience and without experience.

2. Lesson research is not effective in developing pedagogical vision in social science pre-service teachers with teaching experience and without experience.
3. Lesson research is not effective in developing presentation skills in social science pre-service teachers with teaching experience and without experience.

Sampling

A purposive sampling method was followed. Social science pre-service teachers of St. Ann's College of education (Autonomous) was selected for the study. A total of 16 social science students were selected as an experimental group.

Research design

Single group pre-test-post -test design was followed.

Tools

Pre and post- test on content, pedagogical vision and presentation skill were used. The performance of participants was assessed through content test, written assignments and Seminar presentation with PPT.

Methodology

At the beginning of the first semester, orientation was given about the syllabus of pedagogy of social sciences. In St. Ann's College of Education's (Autonomous), first semester syllabus of pedagogy of social sciences focuses on the nature of social sciences, pedagogical aspects and content of the social sciences. Specifically, the third unit includes important topics of social sciences content which are taken from CBSE and SSC social science school textbooks. This unit is added in order to develop content knowledge of school social science subjects for prospective teachers. After the orientation, content knowledge of pre-service teachers was tested by conducting a content test. Assignment was given in the form of lesson research strategy. One lesson from the SSC syllabus textbook of Telangana was given to each student to research the lesson. Every student was given different lessons to research upon. And every student has to research the given lesson in terms of following questions and write the answers for those questions and present it with PPT to the peer group.

Lesson Research questions

1. Read the given lesson and identify concepts, facts and events and principles in the lesson and analyze them with relevant examples.

2. Study Academic standards and write learning outcomes for each academic standard for the lesson.
3. Read the questions given in the lesson and at the end of the lesson and classify them according to academic standards they belong to.
4. Write a minimum of ten objective type questions on the lesson allotted.
5. Identify the activities and teaching learning material which you can use for teaching the lesson.
6. Prepare PPT for your lesson with concepts, videos and pictures, questions and present it in the classroom.

The pedagogical vision and presentation skill of participants was tested before guiding them about lesson research.

Thereafter, teacher educators developed awareness about the nature of social sciences. Academic standards are special features of SCERT school textbooks of Telangana State. At the beginning of the textbooks academic standards to be achieved are mentioned. The teacher explained with examples about Bloom's taxonomy, concepts and importance of academic standards and learning outcomes which are part of the syllabus. Classroom workshop was conducted to train the students in writing learning outcomes for the lesson as per the academic standards. Students in the group practiced how to write learning outcomes for their given lesson. Guidance was given how to research the given lesson collectively as well as individually as per the need.

Orientation was given on how to prepare PPT with relevant concepts, pictures, videos and questions. Then each student was given the opportunity to present the lesson with PPT. PPT included content, images, questions and videos and discussion was held on presentation. The presenter gave questions to the peer group in order to develop conceptual understanding.

Every student's presentation was assessed by a peer group and master teacher. Assignments were collected and assessed by the master teacher. Lastly, a parallel post-content test was conducted. Collected data was statistically analyzed with SPSS.

Findings of the study

Null Hypothesis 1

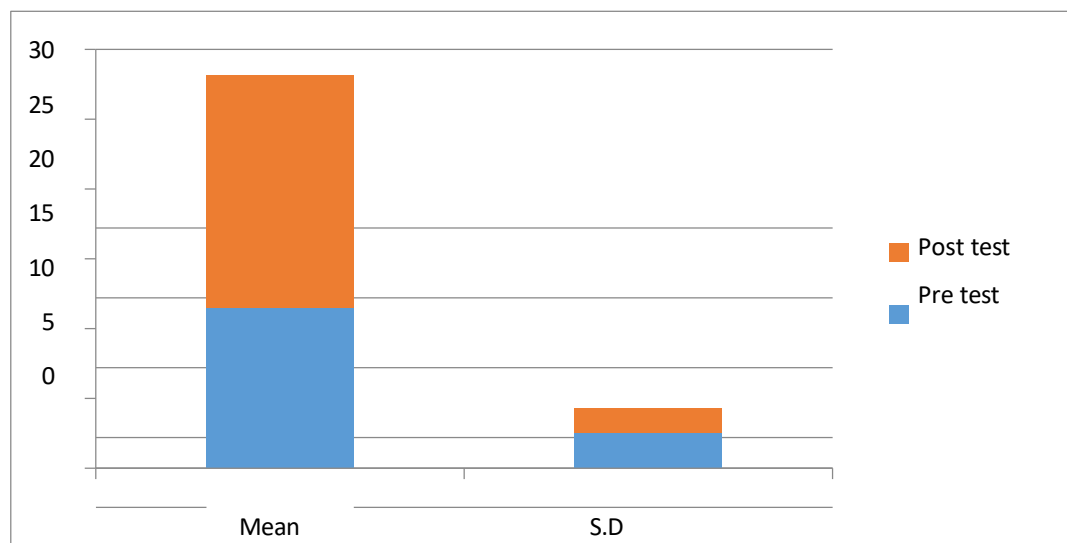
Lesson research is not effective in developing content knowledge in social science pre- service teachers with teaching experience and without experience.

Table 1

Mean and Standard deviation for pre and post content test

Description	Size(n)	Mean (m)	Standard Deviation	t- value	Significance Level
Pre-test-Content	16	11.50	2.55	11.490	0.05
Post-test-Content	16	16.62	1.78		

Graph 1 *Mean & Standard Deviation for pre and post content test*



From table 1, it can be observed that the mean value of pre-test on content is 11. 50 and SD value is 2.55 and mean value of post-test on content is 16. 62 and SD is 1.78. And obtained t-value is 11.49.with 0.05 significance level. It means the null hypothesis is rejected and an alternative hypothesis is accepted. It is proved that lesson research strategy is significantly effective in developing content knowledge in both pre-service teachers with teaching experience and without experience.

Null Hypothesis 2

Lesson research is not effective in developing pedagogical vision in social science pre-service teachers with teaching experience and without experience.

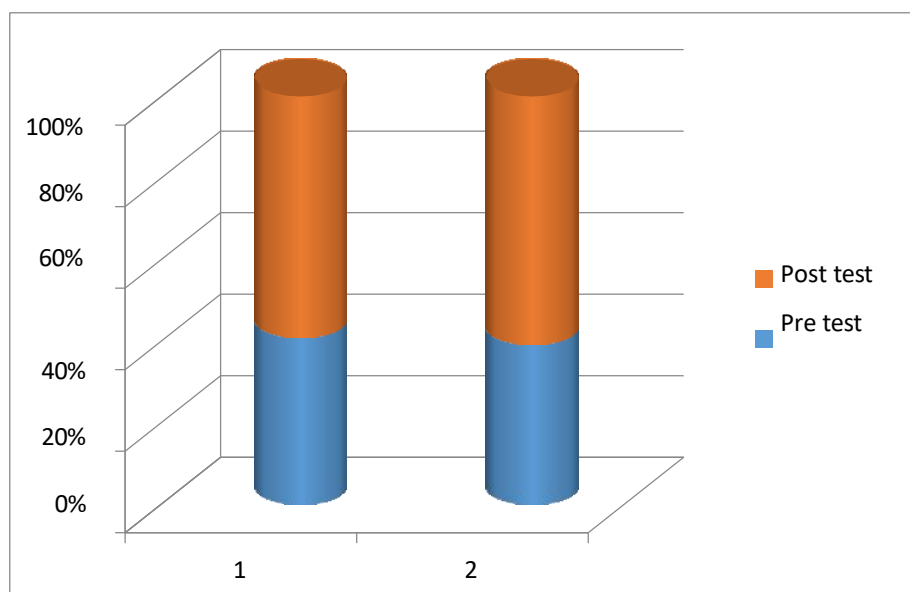
Table 2

Mean & Standard deviation for pre and post test assignment

Description	Size(n)	Mean (m)	Standard Deviation	t-value	Significance Level
Pre-test-Assignment	16	13.00	1.63	12.23	0.05
Post-test-Assignment	16	18.75	2.51		

Graph 2

Mean & Standard deviation for pre and post test assignment



From the table 2, it can be observed that the mean value of pre-test on pedagogical vision is 13.00 and SD value is 1.63 and mean value of post-test is 18.75 and SD is 2.51 And obtained t-value is 12.23. with 0.05 significance level. It means null hypothesis is rejected and an alternative hypothesis is accepted. It is found that lesson research strategy is significantly effective in developing pedagogical vision in pre-service teachers with teaching experience and without teaching experience.

Null Hypothesis 3

Lesson research is not effective in developing presentation skill in social science among pre-service teachers with teaching experience and without experience.

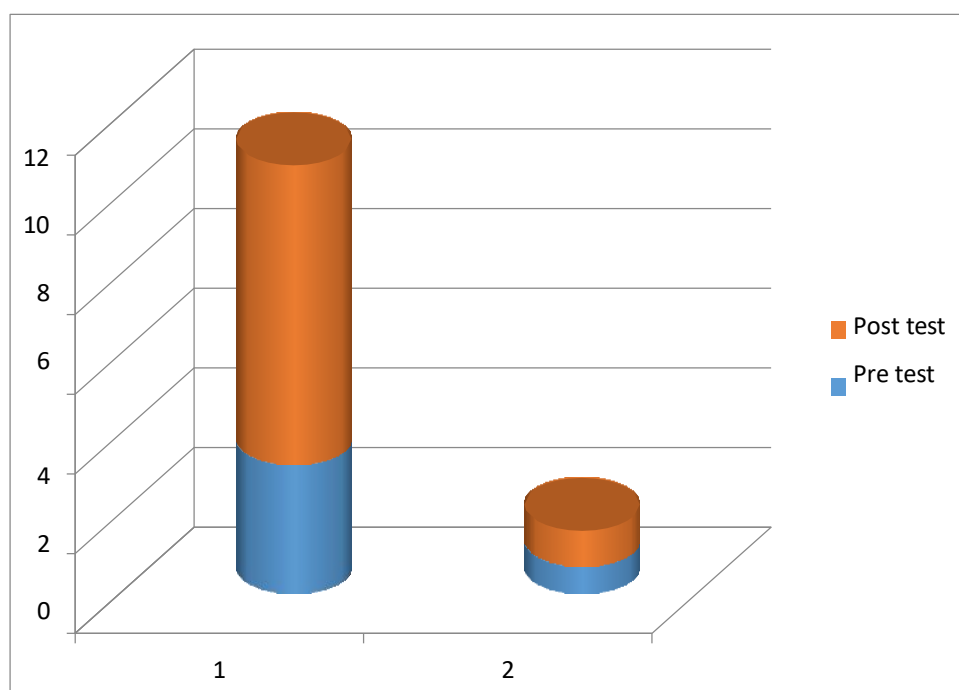
Table 3

Mean & Standard deviation for pre and posttest seminar

Description	Size(n)	Mean (m)	Standard Deviation	t-value	Significance Level
Pre-test-Seminar	16	3.25	.68	24.88	0.05
Post-test-Seminar	16	7.50	.89		

Graph 3

Mean & Standard deviation for pre and posttest seminar



From table 3, it can be observed that the mean value of pre-test on presentation skill is 3.25 and SD value is .68 and mean value of post-test is 7.50 and SD is .89. and obtained t-value is 24.88. with 0.05 significance level. It means the null hypothesis is rejected and an alternative hypothesis is accepted. It shows that there is a significant impact of lesson research strategy in developing presentation skill in both social science pre-service teachers with teaching experience and without experience.

Limitations of the study

1. This study was limited only to examine some of the course outcomes of first semester pedagogy of social sciences.
2. This study was limited only to social science pre-service teachers of St. Ann's college of education (Autonomous) Secunderabad, Telangana state.
3. This study was limited to only pedagogy of social sciences.

Educational implications

Content knowledge of the subject and analyzing it from a pedagogical point of view is the basic competency for teaching any subject. Hence, the result of the study can be applied to other pedagogies of school subjects. This strategy is useful to develop content knowledge, pedagogical vision and presentation skill. It is beneficial to both pre-service teachers with some teaching experience and without teaching experiences.

Conclusion

The study was conducted to develop content knowledge, pedagogical vision and presentation skill in social science pre-service teachers through lesson research strategy. It is found that lesson research strategy was effective in attainment of research objectives. This study helped to develop content competency in pre-service teachers and basic pedagogical skills. This strategy can be used in languages and other subject pedagogies.

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Art and Public Policy

Dr. Lilly Chacko^{7a}

ABSTRACT

A child begins to express itself from birth. One of the most important missions of education of children is to develop their ability to enjoy art and beauty. The concept of arts education is in focus today due to the lack of recognition of the potential of arts in the development of a child. Any education emphasising creativity and innovation must include the arts. Studies reveal that an increase in arts educational experiences has a phenomenal impact on students' academic, social and emotional outcomes. Arts education is considered vital for children as they develop important characteristics like creativity, improved academic performance, confidence, visual learning, decision making, perseverance, and the like. Generally, policies and programs are evaluated based on their effectiveness and evidence which are quantifiable. But arts policies are vulnerable to this risk as we are beginning to understand its value to individuals and humanity. Arts education has intrinsic value which is beyond the limited outcomes captured on standardised tests. National Education Policy 2020 proposes music and arts experiences for every student in the formative years. Our policy makers should think of including arts as a core subject at every stage of a students' education. NCTE needs to revamp its teacher education programs to prepare arts education teachers at all levels of teacher education.

Keywords: *arts, arts education, arts policy*

Introduction

“It is the supreme art of the teacher to awaken joy in creative expressions and knowledge” – Albert Einstein Alexander Baumgarten (1714-1762) first used the term ‘aesthetics’ in his work called *Aesthetica* to mean “perceiving the beauty through senses” particularly in art. One of the most important missions of the education of children and young people is to develop the ability to enjoy art and beauty. UNESCO considers culture and arts as essential components of a comprehensive education leading to the full development of the individual (UNESCO, 2006). Art education has invariably been central to our lives and thus education through the art forms has always been an inherent genre of Indian Culture.

Many of India's greatest philosophers argued that education aims at overall development of children and believed that education remains incomplete without the teaching of aesthetics

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or fine arts (NCERT 2010). On the other hand, in this increasingly materialistic world, how to properly balance the mind and body where the senses are awakened thus leading to the creation of the child as a total being has puzzled educators across the globe. The arts claim to enrich our understanding of the world, challenge prevailing ideologies, widen our perspectives, engage and delight us, and celebrate our humanity (Fleming, 2012). The idea of arts education was present in pedagogical theories since antiquity. The role of art and the beauty in shaping the individual has been debated (Denac, 2014). Herbert Read argues that the basic error of all educational systems and their methods is in their focus on rational thinking. Read finds that harmony and balance in the child's personal integrity can be maintained through aesthetic culture and training him to live in a creative and natural manner can be achieved only through arts education (Gilbert and Kuhn, 1967).

Today many schools do not offer arts programs, the reason cited being budgetary constraints and increased focus on academics. Many school principals and teachers are unaware of the value of arts education. The students who have no access for arts education are missing an important facet in their education

Aesthetic Education

The concept of aesthetic education arose due to the lack of recognition of the importance of arts and its potential in the education and development of the child. Aesthetic education is conceived as a total commitment to the arts and what they have to offer in human development as an essential birth right of the child as he begins his education (Weitz M, 1972). Smith (1970) argues that aesthetic education can imply "the development of sensitivity to the aesthetic aspects of anything whatsoever, including the aesthetic character of the environment, or even of teaching and learning activities; irrespective of subject or context of schooling." He further states that aesthetic education does not limit itself to the use of exemplary works of art in the classroom, but also allows for the use of popular arts, crafts, nature and utilitarian objects. Elliot Eisner (1965) regarded aesthetic education as humane education in and through arts. Friedrich Schiller (1759-1805) states that 'the experience of Beauty is a necessary condition for the emergence of full humanity' and therefore in the evolution of civilization the aesthetic path must be taken "because it is through Beauty that man makes his way to Freedom."

Aesthetic Experience

Aesthetic experience is a prominent element in arts education. Ralph Smith (1991) argues that aesthetic experience is central to aesthetic education. Educating through aesthetic experience

revolves around the hopes of modern educational philosophies to improve individuals and societies and enhance the progress of humankind (UNESCO, 2006). According to Smit (1980), the principal role of art in the human career is to raise the level and quality of experience by giving it an aesthetic character. Schorr (1967) argues that “reasoning is central to living” and ‘Art’s unique contribution is aesthetic experience’ and therefore seeking of such experience be made central to art education.

Aesthetic Education Curriculum and Pedagogy

In many societies education systems have become stifled by excessive bureaucracy, mechanical systems, quality control, quantitative judgements, clear outcomes and the pursuit of general rules that are oblivious to context (Habermas, 1987). Many countries place emphasis on literacy attainment rather than literacy engagement (Guthrie, 2004). In contemporary society, precise analytical thinking has taken precedence over contextual vision and experience so that ‘an increasingly mechanistic, fragmented, decontextualized world has come about (Greene, 1995). Shusterman (2002) argues that ‘in a society dominated by ideals of material profit and means-end rationality, art’s deep sense of play and non-instrumental purposiveness represents a striking and challenging alternative’. This is an age where communities and nations look for economic success. To achieve it, we need people that reflect and reinforce the values, priorities and requirements of the creative age. Therefore, education reform must make schools into places where human creativity is cultivated and can flourish (Florida, 2005).

Aesthetic education is currently one of the core subjects taught at school worldwide. In 1999, UNESCO made an international appeal for the promotion of arts education and creativity at school as part of the construction of a culture of peace (UNESCO, 2005). A working document of UNESCO on building capacities for the 21st century states ‘Art Education is a tool for equipping students with knowledge and skills across the curriculum to stimulate cognitive development and to encourage innovative and creative thinking’ (UNESCO, 2006). In the USA, in 2001, the arts were included as a core academic subject in the ‘No Child Left Behind Act.’ The Asian Vision for Art Education emphasises the importance of learning that occurs through the art in terms of (a) creative, perceptual and cognitive skills (b) aesthetic skills of harmony, balance, rhythm, proportionality and vitality, and a love for beauty (c) communication, teamwork and sharing skills, and (d) an understanding of Asian cultures and value systems (UNESCO 2005:9).

An understanding of the arts of the country will give our youth the ability to appreciate the richness and variety of artistic traditions as well as make them liberal, creative thinkers and good citizens of the nation (NCERT, 2006). One of the main recommendations of the National Curriculum Framework (NCF 2005, 2023) for promoting and implementing arts in schools is integration of arts across the school curriculum. The focus group (NCERT) recommends that “art education must become a subject taught in every school as a compulsory subject (up to class X) and facilities for the same may be provided in every school. NCERT has created the Department of Education in Arts and Aesthetics (DEAA) as a separate unit in 2005 to promote all forms of art in schools.

Critical evidence: How arts education benefits student achievement

According to Tagore, “Art is the response of an individual’s creative soul to the call of the Real.” Dewey defines art as “To feel the meaning of what one is doing, and to rejoice in that meaning: to unite in one concurrent fact the unfolding of the inner life and the ordered development of material conditions – that is art” (Dewey, 1906/1977, p.292). Tolstoy (1959) states that the value of art consists in widening man’s outlook, in increasing the spiritual wealth that is humanity’s capital. Education in general and art education in particular is a way for one to grow and become sensitive to the beauty in nature, of social values and the aesthetic aspects of life as whole (NCERT, 2010). Victor Lowenfeld, one of the most influential art educators in the 1940s suggests that in order to foster aesthetic growth, art can play a major role. The main purpose of Arts Education according to NCERT (2010) is to develop creativity, individuality and expression through art activities.

A critical challenge for arts education has been a lack of empirical evidence that demonstrates its educational value. Though people agree with the intrinsic value of arts, advocating “art for art’s sake” has been insufficient for sustaining the arts in schools. One of the reasons for the decline of schools offering arts education is due to the increased focus on standardized test-based accountability.

Researchers have contributed evidence to show that art education positively affects many aspects of learning and living. Various benefits of arts include deeper development of imagination (Greene, 1995), greater motivation to learn (Csikzentmihalyi, 1997), increased achievement in mathematics and languages (Butzlaff, 2000, Forgeard, Schlaug, et al., 2008, Vaughn, 2000), enhanced neural activity in the brain (Jensen, 2001), greater student creativity, lower dropout rates, and positively enhanced social skills (Catterall 1998, Luftig, 1995).

Research has also demonstrated that studying the arts can support the development of self-regulation which includes paying attention, using feedback effectively, problem solving in a curricular context, taking risks, cooperating and setting goals (Baum, Owen and Oreck, 1997). Though research evidence claims that arts have a positive effect on academic achievement, there is a warning against the academic achievement argument, insisting that 'the presence of arts in our schools should not rest on whether or not learning in the arts transfers to other academic domains (Winner and Hetland, 2000).

A study conducted on the Maryland school system named "Reinvesting in Arts Education" (2011) concluded that skills learned in the visual arts could help improve reading and mathematics. The report also suggested that arts education can be a valuable education reform tool to motivate students and improve standardized test scores. In 2008, the Dana Foundation conducted a series of studies by neuroscientists from seven prestigious universities and released Learning, Arts and the Brain, the Dana Consortium Report on Arts and Cognition. The study found that there exists a tight correlation between exposure to the arts and improved skills in cognition and attention for learning.

A meta-analysis of 62 studies of various categories of art including dance, drama, music and visual arts by nearly 100 researchers revealed that school children involved in drama, music and dance are often more proficient at reading, writing and mathematics (Catterall, 2002). He suggested that "While education in the arts is no magic bullet for what ails many schools, the arts warrant a place in the curriculum because of their intimate ties to most everything we want for our children and schools." Winner E and Hetland L (2007) conducted an arts education program named Project Zero at Harvard Graduate School of Education and found that arts don't improve academic performance. On the other hand, it helps students improve visual analysis skills, learn from mistakes, be creative and make better critical judgements.

As education policymakers increasingly rely on empirical evidence to justify decisions, advocates of arts education find it difficult to preserve the arts classes from LKG to class XII. There is a remarkable lack of large-scale experimental studies that investigate the educational impacts of the arts. However, the outcome of arts education extends beyond the commonly reported outcomes such as mathematics and reading test scores.

Museum trips by randomly chosen students revealed that the students "improved their knowledge of and ability to think critically about art, display stronger historical empathy, develop higher tolerance, and are more likely to visit such institutions in the future" (Greene,

Kisida, & Bowen, 2014). Students selected at random for theatre outings demonstrated better knowledge of plot and vocabulary associated with the show as well as higher scores on a scale of reading other people's emotions—a measure taken on average 47 days after the show, suggesting more than a temporary benefit (Greene et al., 2015).

Conclusion

It can be claimed that some of the most important aspects of education can be achieved through arts, and thus arts should be regarded as part of the core curriculum. Art is the highest means of knowledge and helps in the improvement of humanity. Aesthetic education helps develop norms and standards for individuals' pursuit of a good life. In the making of a human being with a beautiful mind, empathetic knowledge plays an important role. Aesthetic education aims to foster empathetic knowledge and hence it is integral to the curriculum. If we aim for a proper balance between the mind and body of a child which leads to the development of the child as a total being, aesthetic education should be given its paramount importance.

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An Assessment of Library Facilities and Information Resources in Higher Education Institutions: A Teacher's Perspective

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ABSTRACT

This study investigates the role of libraries in fostering a knowledge-based economy through the eyes of teachers. A qualitative method approach was employed, surveying 10 teachers, from a government degree college in Hyderabad. A Self-developed questionnaire was utilized to collect data, which was analysed qualitatively using percentages, tables, and graphs. Results showed that faculty were accessing library resources to meet their professional goals. However, findings highlighted a significant gap in digital library facilities and resources. This study provides a foundation for recommending more free access to modern digital facilities in the libraries of higher education colleges, emphasizing the need for libraries to adapt to technological advancements and cater to the new developing demands of higher education institutions.

Keywords: *Library facilities, Library information resources, teachers & Higher Education Institutions*

Introduction

Libraries play a vital role in education, providing access to diverse resources, promoting knowledge acquisition, and facilitating academic and professional growth. As a hub of learning, libraries are essential for improving the educational process and advancing societal development. Libraries are the cornerstone of academic institutions, providing access to a vast array of knowledge resources that facilitate teaching, learning, and research (Kothari Education Commission, 1964-65). As James H. Bollington aptly puts it, "Libraries are starting places for all the adventure of learning... Libraries are our base camp." The obtained knowledge needs to be transmitted among the users such that a powerful knowledgeable society is being emerged (Doraswamy Naik 2018). The advent of digital technologies has transformed the functioning of libraries, enabling the creation of digital libraries that provide users with convenient access to knowledge resources (Maria, 2019).

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However, the effectiveness of library services in supporting professional endeavours remains a subject of inquiry. The present study aims to investigate the role of libraries in accentuating professional growth & development of teachers in higher education institutions, examining the library facilities and information resources available and the impact on their academic and professional outcomes. By exploring the complex relationship between libraries and professional success, this study seeks to contribute to the existing body of knowledge and provide insights that can inform library policy and practice. This study also highlights the scope of library services and information resources on teaching, learning, and research quality in higher education institutions.

Review of related literature

Numerous studies have investigated the role of libraries in supporting academic success. Obu and Evelyn (2023) examined postgraduate students' satisfaction with information resources at a university library in Nigeria, revealing a positive correlation between library resources and student satisfaction. Similarly, Shoaib et al. (2022) evaluated library services and facilities during the pandemic in Pakistan, highlighting the importance of digital libraries and online services. Yousuf et al. (2022) investigated user satisfaction with academic library information resources, facilities, and services at a polytechnic library in Nigeria, finding that ease of access and quality of services contributed positively to library use.

Other studies have focused on assessing library services and facilities. Rayapudi and Irrinki (2021) conducted a study on the assessment of library services and facilities among postgraduate students, revealing areas for improvement. Alokuk (2020) examined the attitude of students towards library facilities, finding a positive attitude but highlighting the need for improved services. Ningoji and Sadashivappa (2020) investigated user satisfaction with library resources, facilities, and services at a B.Ed. college, recommending regular user studies and library literacy programs.

Research has also explored the impact of library services on academic success. Abukari (2019) examined the utilization and user satisfaction of library resources and services at a college library in Ghana, finding overall satisfaction but highlighting areas for improvement. Khan et al. (2019) evaluated user satisfaction with library and information resources and services at a college library in India, recommending improved library services and resources. Ikolo (2018) investigated user satisfaction with library services at a university library in Nigeria, finding a

significant relationship between library collection assessment and user satisfaction.

Earlier studies have also contributed to the understanding of library services and academic success. Onanuga et al. (2017) conducted research on library service utilization and satisfaction among undergraduate students in Nigeria, recommending improved library services and resources. Singh and Kuri (2017) investigated user satisfaction with library resources and services at IIT libraries in India, providing suggestions for improvement. Nworkedi et al. (2017) assessed new physical facilities and user satisfaction at a university library in Nigeria, recommending user education programs and improved facilities. Ramakrishna et al. (2016) studied the availability and usage of library and information resources and services at a university library in India, finding overall satisfaction with library facilities and services.

Other researchers have explored the impact of library services on academic success in various contexts. Rahoo et al. (2015) examined library usage and services at a university library in Pakistan, highlighting areas for improvement. Benard (2014) conducted a study on the assessment of access and use of library information resources by higher education students in Tanzania, recommending improved library services and resources. Barik (2013) pursued a case study of assessment of library services at an engineering college library in India, providing suggestions for improvement. Ayob (2011) conducted a study on the effectiveness of library resources and services in supporting researchers' information needs, highlighting areas for improvement.

Thus, the review of literature underscores the need for a comprehensive examination of library facilities and information resources in higher education colleges, incorporating recent technological advancements. The present study addresses this gap by investigating the current state of library facilities and resources, exploring their impact on students' progress, teacher professional development, and institutional enhancement. Utilizing a case study methodology, this research provides nuanced insights into the institution's unique environment, challenges, and opportunities, informing data-driven decisions and driving innovation in library services to elevate the academic experience.

Objectives of the Study

To examine the satisfaction of teachers towards the library facilities and library information resources provided to them.

Research Methodology

The population of the present study consists of students enrolled in the higher education

institutions in the district of Hyderabad, Telangana State. A Government College for Women Hussaini Alam, Hyderabad has been selected as a case of research study via purposive sampling technique. A sample of 10 teachers have been selected to infer the data through purposive sampling technique. The qualitative variables of library facilities, information resources & Higher Education Institution has been opted as nominal & ordinal variables.

Designing Research Tools & Data Administration

In this study the researcher has utilized a self-made questionnaire for data collection. Before developing the tool & items, objectives of the test and areas to be measured were identified. According to these areas, dimensions were found out which would help to know the characteristics for which tools were designed. Observation was conducted indirectly to check the whole environment of library services & information resources as well as to find the theme. Depending upon those dimensions, 32 statements were formed with the purpose to get information as intended in the language most used in the respective areas. The collection of items was mainly done from teachers and experts in the field, by contacting personally & using informal discussion. A mixed type of questionnaire was prepared and some questions were Likert type five-point rating scale. The questionnaire was prepared by the researcher with alternatives: strongly agree, agree, undecided, disagree & strongly disagree. The questionnaire for teachers had 21 items in total.

In order to set the reliability of the tool a pilot study was conducted to pave the way for reliability & validity. The validation was done under the guidance of the supervisor & subject experts. The self-developed questionnaire has content validity.

Date Collection & Organization

The tool was administrated on teachers working in higher education institutions as mentioned earlier. Personal contact was made to supply and collect back the response booklet of the questionnaire. Instructions were given to them to provide accurate data. For data collection, official permission from the Principal of the College was taken. The respondents were given proper instruction & time to answer the distributed questionnaire by the researcher.

Data Analysis, Interpretation, Findings & Discussion

In order to achieve the set objectives of the study the researcher has used the most appropriate statistical technique of Percentage for the data analysis. Tables have been shown with Pie charts & graphs as per the nature of variables involved in the study.

Data Interpretation of ‘Questionnaire for Teachers on Assessment of Library Facilities and Information Resources in Higher Education Institutions’

Item 1 Do you feel comfortable using the library?

Table 1

Distribution of responses with reference to item 1

Response Category	N	Percentage %
Yes	10	100
No	0	0

The above table shows the faculty satisfaction towards the library. Teachers are fully satisfied with the use of the library.

Discussion

The findings suggest that the library is meeting the needs and expectations of faculty members, as evidenced by the 100% satisfaction rate. This is a significant finding, as it indicates that the library is providing adequate support for faculty research, teaching, and scholarship.

The high level of satisfaction among faculty members may be attributed to the library's collection, services, and facilities. It is possible that the library's resources and support staff are adequately meeting the needs of faculty members, leading to increased satisfaction.

The results of this study are consistent with previous research, which has highlighted the importance of libraries in supporting students & faculty in research & teaching (Shoaib M. et al (2022)). The findings of this study suggest that the library is playing a critical role in supporting the academic success of faculty.

Item 2 *How libraries are helpful for you?***Table 2***Distribution of responses with reference to item 2*

Response Category	N	Percentage %
In Reading	3	30
In Promoting Lifelong Learning	4	40
In Personal Development	1	10
Gain Knowledge	2	20

Table 2 indicates that libraries were deemed helpful in promoting lifelong learning (40%), reading (30%), gaining more knowledge (20%), and personal development (10%). Notably, the majority of faculty (40%) believed that libraries played a crucial role in promoting lifelong learning.

Discussion

The finding of Item 2 highlights the importance of libraries in promoting lifelong learning and academic success. The fact that 40% of faculty members believed that libraries played a crucial role in promoting lifelong learning suggests that libraries are valued as a key resource for supporting the academic and professional development of faculty.

The results also suggest that libraries are perceived as being helpful in promoting reading, gaining more knowledge, and personal development. These findings are consistent with previous research, which has highlighted the importance of libraries in supporting student learning outcomes and academic success (Obu R.A. & Evelyn S. G. ,2023). Overall, the findings suggest that libraries are a vital resource for supporting the academic and professional development of faculty, and that they play a crucial role in promoting lifelong learning and academic success.

Item 3 *How do you feel about the way your college library is organised?***Table 3***Distribution of responses with reference to item 3*

Response category	N	percentage %
I love it	7	70
I Like it	3	30
It's ok	0	0
I Don't know	0	0

Table 3 reveals that a significant majority (70%) of faculty members expressed a strong affection for the library organization, stating they "love it", while 30% reported a positive sentiment, stating they "like it better".

Discussion

The findings suggest that faculty members have a highly positive perception of the library organization in the college. The fact that 70% of faculty members expressed a strong affection for the library organization, stating they "love it", indicates a high level of satisfaction and appreciation for the library's resources and services.

The positive sentiment expressed by faculty members may be attributed to the library's efforts to provide relevant and timely support for teaching, learning, and research. The library's commitment to excellence in customer service, collection development, and instructional support may have contributed to the high level of satisfaction among faculty members. The findings suggest that the library organization in the college is meeting the needs and expectations of faculty members, and is viewed as a valuable partner in the academic enterprise.

Item 4 *Library facilities: lending service.***Table 4***Distribution of responses with reference to item 4*

Response category	N	percentage %
Fully Satisfied	9	90
Satisfied	1	10
Neutral	0	0
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 5 *Library facilities: Seating space.***Table 5***Distribution of responses with reference to item 5*

Response category	N	percentage %
Fully Satisfied	4	40
Satisfied	6	60
Neutral	0	0
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 6 *Library facilities: Computer or Internet.***Table 6***Distribution of responses with reference to item 6*

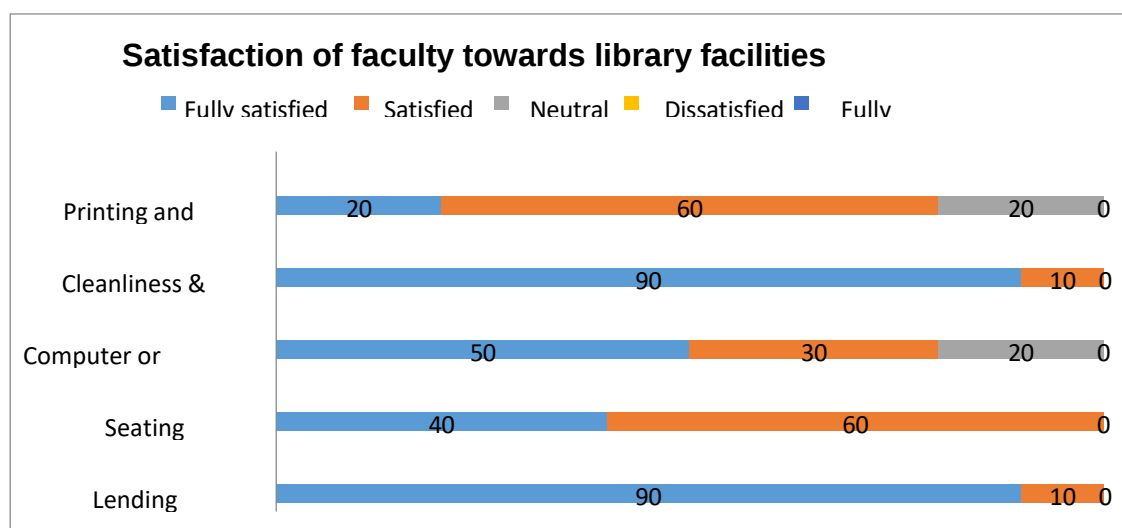
Response category	N	percentage %
Fully Satisfied	5	50
Satisfied	3	30
Neutral	2	20
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 7 Library facilities: Printing and xeroxing service.**Table 7***Distribution of responses with reference to item 7*

Response category	N	percentage %
Fully Satisfied	2	20
Satisfied	6	60
Neutral	2	20
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 8 Library Facilities: Cleanliness and Lightning.**Table 8***Distribution of responses with reference to item 8*

Response category	N	Percentage %
Fully satisfied	9	90
Satisfied	1	10
Neutral	0	0
Dissatisfied	0	0
Fully dissatisfied	0	0

Figure 1*Satisfaction of faculty towards library facilities*

The above figure provides a detailed breakdown of (Tables 5-8) the faculty members'

satisfaction levels with various library facilities. The results are as follows:

Lending services: 90% of faculty members reported being fully satisfied, while 10% were satisfied.

Seating space: 40% were fully satisfied, and 60% were satisfied, indicating overall satisfaction with this facility.

Computer/internet services: 50% were fully satisfied, 30% were satisfied, and 20% were neutral.

Cleanliness/lighting: 90% were fully satisfied, and 10% were satisfied, indicating a high level of satisfaction with this facility.

Printing/ Photocopying services: 20% were fully satisfied, 60% were satisfied, and 20% were neutral, indicating room for improvement.

Discussion

The findings suggest that faculty members are generally satisfied with the library facilities, with high levels of satisfaction reported for lending services, seating space, and cleanliness/lighting. However, the results also indicate areas for improvement, particularly with regards to computer/internet services and printing/ photocopying services.

The high level of satisfaction with lending services and cleanliness/lighting suggests that the library is meeting the basic needs of faculty members. However, the lower levels of satisfaction with computer/internet services and printing/ photocopying services indicate that the library may need to upgrade its technology infrastructure and printing facilities to better support the needs of faculty members. (Onanuga et al (2017).

Item 9 Library information resource: Professional literature.

Table 9

Distribution of responses with reference to item 9

Response category	N	percentage %
Fully Satisfied	8	80
Satisfied	2	20
Neutral	0	0
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 10 Library Information Resources: Music, Audio and Video resources.**Table 10***Distribution of responses with reference to item 10*

Response category	N	percentage %
Fully Satisfied	1	10
Satisfied	6	60
Neutral	3	30
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 11 Library Information Resources: General and Educational Books.**Table 11***Distribution of responses with reference to item 11*

Response category	N	percentage %
Fully Satisfied	10	100
Satisfied	0	0
Neutral	0	0
Dissatisfied	0	0
Fully Dissatisfied	0	0

Item 12 Library Information Resources: Journals, Articles and Newspaper.**Table 12***Distribution of responses with reference to item 12*

Response category	N	percentage %
Fully Satisfied	4	40
Satisfied	6	60
Neutral	0	0
Dissatisfied	0	0
Fully Dissatisfied	0	0

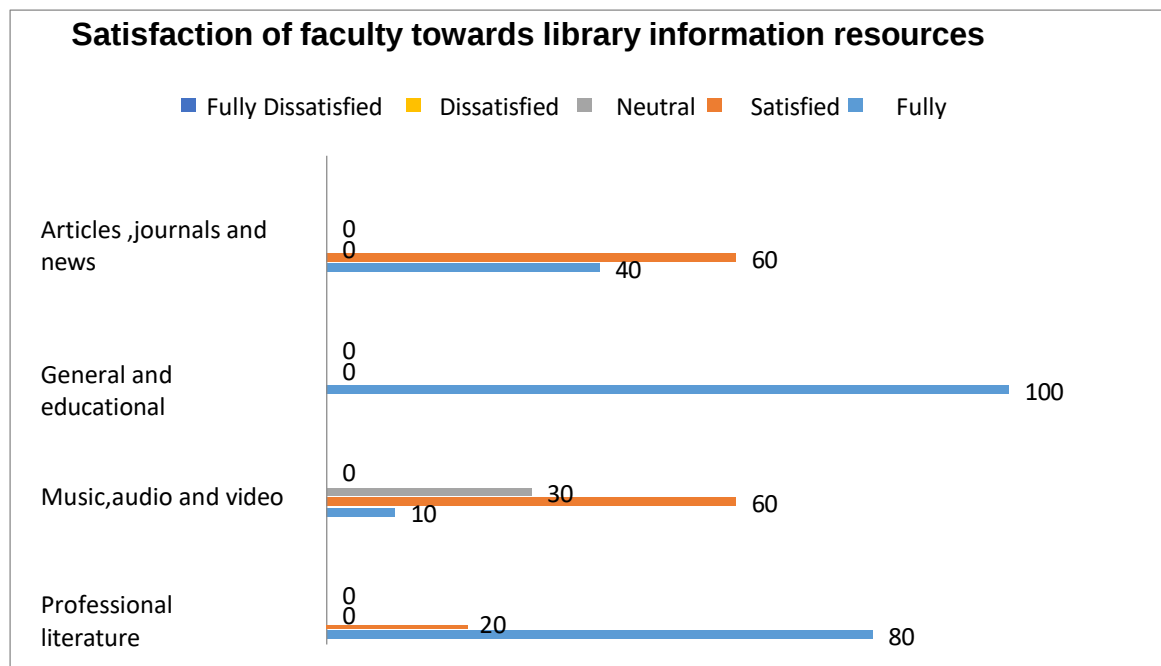
Figure 2*Satisfaction of faculty towards library information resources*

Figure 2 presents teachers' satisfaction levels with various library information resources. The results are as follows:

Professional literature: 80% of faculty members reported being fully satisfied, while 20% were satisfied, indicating a high level of satisfaction.

Music, audio, and video resources: 10% were fully satisfied, 60% were satisfied, and 30% were neutral, indicating overall satisfaction.

General and educational books: 100% of faculty members were fully satisfied with this resource.

Articles, journals, and newspapers: 40% were fully satisfied, and 60% were satisfied, indicating a high level of satisfaction.

Discussion

The findings suggest that faculty members are generally satisfied with the library's information resources, with high levels of satisfaction reported for professional literature, general and educational books, and articles, journals, and newspapers. The fact that 100% of faculty members were fully satisfied with general and educational books suggests that the library is providing adequate support for teaching and learning.

The lower level of satisfaction with music, audio, and video resources may indicate a need for the library to enhance its collection in these areas or provide additional support for faculty members using these resources. The findings of the study suggest that the library is generally meeting the needs of faculty members, but that there are areas for improvement that need to be addressed.

Delimitations of the Study

There are certain restrictions on this research study. First of all, because it is a case study, generalization was limited. Secondly, because of scheduling restrictions, the sample size was minimal. Furthermore, the study used qualitative questionnaires and basic purposive sampling, which might not have produced the most accurate or trustworthy data. Lastly, data analysis was restricted to percentage computations; deeper insights could have been obtained using more sophisticated statistical methods.

Suggestions for Further Research

Further research is required to explore the role of libraries in reinforcing faculty research and scholarship, especially in the context of emerging technologies and interdisciplinary collaboration. Additionally, studies comparing the effectiveness of different assessment methods for determining library facilities and resources would provide valuable insights. Testing the relationship between library facilities and accreditation standards, as well as conducting comparative studies across different types of higher education institutions, would also contribute to a deeper understanding of the complex interactions between libraries, institutions, and professional growth & development.

Higher institutions should prioritize the development of well-equipped libraries that cater to the different needs of teachers. Continuous & regular assessments of digital library services & information sources should be executed to safeguard their relevance and effectiveness. A minimum set of library services, including reference, internet, seating, and web-based resources, should be imparted to enhance teaching and learning quality. Furthermore, libraries should evaluate the significance of their collections and collaborate with other libraries to enhance resource sharing and accessibility. Finally, libraries should develop transparency by sharing assessment results with stakeholders and soliciting feedback to inform future improvements.

Conclusion

Library facilities and information resources are essential to boost up morale as well as the continuous professional growth & development of the teacher fraternity all over the globe. These embrace fulfilling instructional goals, accelerating research & providing specialized teaching, learning & research materials to the users. That in turn accelerates the academic & professional improvements & advancements in the entire higher education economy.

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Mathematisation and Mathematical intelligence: Two Pillars of Meaningful Mathematics Learning

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Abstract

The main goal of mathematics education in schools is the “mathematisation of child’s thought processes.” It is more useful to know how to mathematise than to know a lot of mathematics-practicability to real life is more important than the theoretical part. Students should enjoy learning mathematics. Making Mathematics a part of children’s life experiences is the best mathematics education possible. Mathematisation bridges the gap between theoretical mathematics and its practical applications and empowers the students to see the world through a mathematical lens. On the other hand, mathematical intelligence is the cognitive ability of the learner to think logically, solve problems creatively and make a sense of abstract relationships. These two are great pillars for cultivating meaningful, relevant and life-long mathematical understanding.

Keywords: *Mathematisation, Mathematical intelligence, NEP 2020, competency-based learning, higher-order thinking, cross-disciplinary learning.*

Introduction

“Mathematics is not a subject to be feared; it is a language to be understood.” – A beautiful way to shift perspectives from anxiety to appreciation.

What does it mean to understand Mathematics? Is it the ability to solve sums, memorize formulae and ace exams? Mathematics is not just solving the textbook problems and getting right answers, following step-by-step procedures. In today’s world—shaped by rapid technological advancement, complex global problems, and an increasing need for interdisciplinary thinking—mathematics must evolve beyond rote learning. The focus is shifting toward **conceptual understanding, critical thinking, and real-world application**. In other words, mathematics is no longer taught as an isolated body of knowledge but as a dynamic tool to understand and navigate the world.

This evolution is influenced by global education reforms, including the **National Education Policy (NEP) 2020** in India, which emphasizes competency-based learning and higher-order thinking.

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Two essential ideas support this vision: **Mathematisation** and **Mathematical Intelligence**.

Mathematisation: In simple terms, mathematisation is the process of turning a real-life situation into a mathematical problem.

Horizontal Mathematisation: Horizontal mathematization refers to the process of applying mathematical concepts to real-world situations.

Vertical Mathematisation: This involves refining and reorganizing mathematical knowledge within the formal system of mathematics.

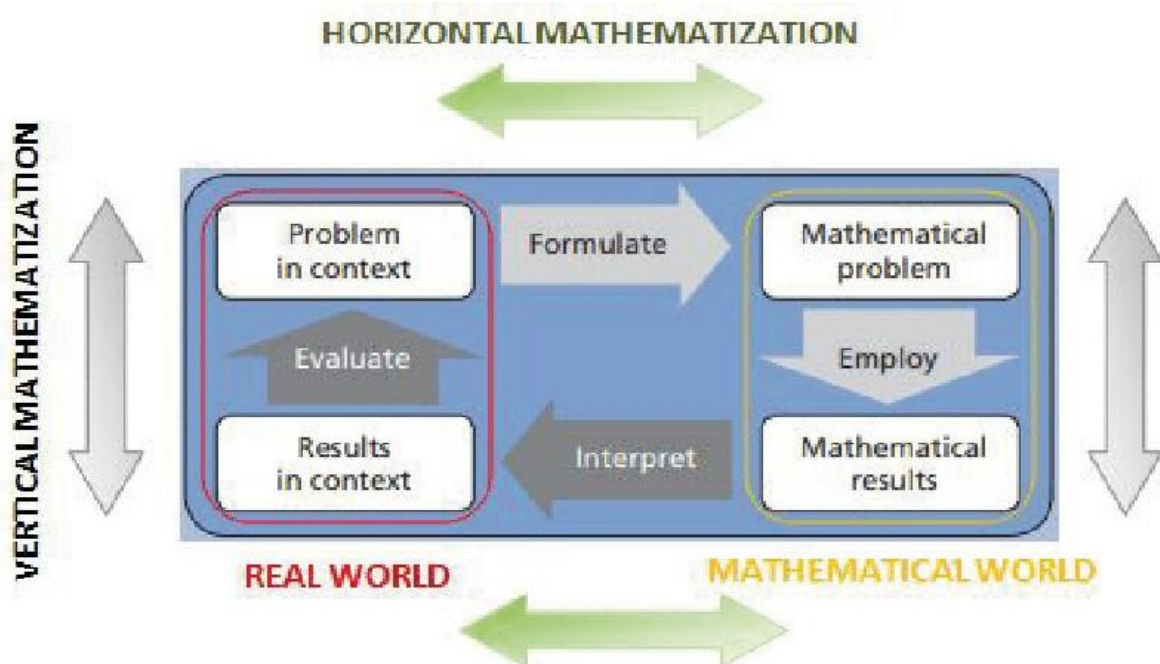


Fig 1: Diagrammatic representation of Horizontal and Vertical Mathematisation

For example,

- Planning a travel budget for a group of 5 friends – understanding the context, representation in a tabular form, analyse and interpret the tabular data; and share their expenses accordingly.
- In cooking or baking, a recipe is a set of mathematical instructions. Adjusting the quantities of ingredients to make more or less of a dish, or converting between measurement systems (e.g., cups to grams) are examples of mathematisation.

Levels of Mathematisation :

Mathematisation is not a one-size-fits-all process; it develops in stages as learners engage more deeply with mathematical ideas and real-world situations. According to Realistic Mathematics Education (RME), mathematisation can be viewed at multiple levels:

- **Informal/Contextual Level:** Learners begin with intuitive understandings drawn from daily experiences. They use trial and error, guesses, or visual representations to make sense of a problem.
- **Semi-formal Level:** Learners start using structured representations such as tables, graphs, or diagrams to make connections. They can articulate strategies and make rough generalizations.
- **Formal/Abstract Level:** Learners apply mathematical symbols, algebraic reasoning, and formal procedures to solve complex problems with efficiency and abstraction.

Understanding these layers helps educators scaffold instruction that builds students' capacity progressively—starting from lived experience and gradually moving toward abstract generalizations.

The main goal of mathematics education in schools is the “mathematisation of child’s thought processes.” It is more useful to know how to mathematise than to know a lot of mathematics- practicability to real life is more important than the theoretical part. Students should enjoy learning mathematics. Making Mathematics a part of children’s life experiences is the best mathematics education possible.

Mathematics is a part of the daily life experiences for all of us. In playing cricket or any other sport, children follow rules and conditions when different situations arise and then, use them as a whole. They prove, disprove and argue giving reasons with established rules. Children also create different patterns during festivals using lines, triangles, circles with varied symmetries. They also use estimation, problem-solving, approximation and reasoning skills in shopping. ***Making these experiences a part of classroom teaching lies at the core of “mathematisation of child’s thinking.”*** If children are motivated to explore linkages between school and life situations, a natural mathematisation process can take root in their minds.

Mathematisation bridges the gap between theoretical mathematics and its practical applications and empowers the students to see the world through a mathematical lens.

Regarding its significance, for students it helps in developing their ability to solve real-life problems and builds confidence in understanding and learning Mathematics meaningfully out of interest and not assume it as a “Demon in life” and run away from it. Mathematisation encourage teachers to promote interdisciplinary teaching by relating math to science, geography, economics etc.

Mathematical Intelligence: It refers to the cognitive ability of the learner to think logically, solve problems creatively and make a sense of abstract relationships. This form of intelligence is not limited to those who “score high in math” but can be nurtured in them through the right strategies.

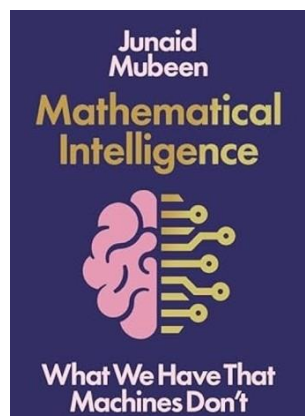


Fig 2: Mathematical Intelligence

The key traits of Mathematical intelligence include a deep thinking and understanding of complex concepts and identifying an aptitude for math-related subjects. It reflects a person’s natural ability or strength in reasoning and problem solving. It influences how quickly and effectively students grasp mathematical concepts. It helps the students understand their own learning strengths and preferences, boosts their confidence and encourages curiosity, problem-solving and a growth mindset in the students.

Cognitive Strength + Growth Mindset

- While Gardner viewed it as a *natural intelligence*, research (Jo Boaler, Carol Dweck) shows it can be **nurtured**.
- A growth mindset—“I can get better at math with practice”—directly strengthens mathematical intelligence.

Mathematical Intelligence supports Higher-Order Thinking Skills (HOTS) - Builds skills like analysis, evaluation, synthesis, and modelling. Example: Analysing population data, evaluating trends, predicting outcomes. Mathematical intelligence underpins fields like AI, engineering, economics, data science, architecture, and even music and linguistics (where pattern and structure are key). Seen in **arts** (proportion, perspective, rhythm), **science** (formulas, experiments), **geography** (maps, scales), and **economics** (statistics, percentages). This makes it a central hub in **STEAM/STREAM education**. Students with high mathematical intelligence can make reasoned approximations and educated guesses. A surprising insight: mathematical thinkers often use logic to manage conflicts, make fair decisions, and weigh options rationally. So, MI (Mathematical Intelligence) isn't only cognitive—it helps with *life skills*. Brain studies show mathematical intelligence is linked to both the left hemisphere (logic, sequence) and right hemisphere (spatial, visualisation). This dual involvement explains why math is both logical *and* creative. In today's world of coding, algorithms, and data, mathematical intelligence forms the **core of digital and AI literacy**. Puzzles, riddles, strategy games, and coding tasks bring out mathematical intelligence in enjoyable ways. This breaks the stereotype of mathematics being “dry.”

Conceptual Circular Flow Chart:

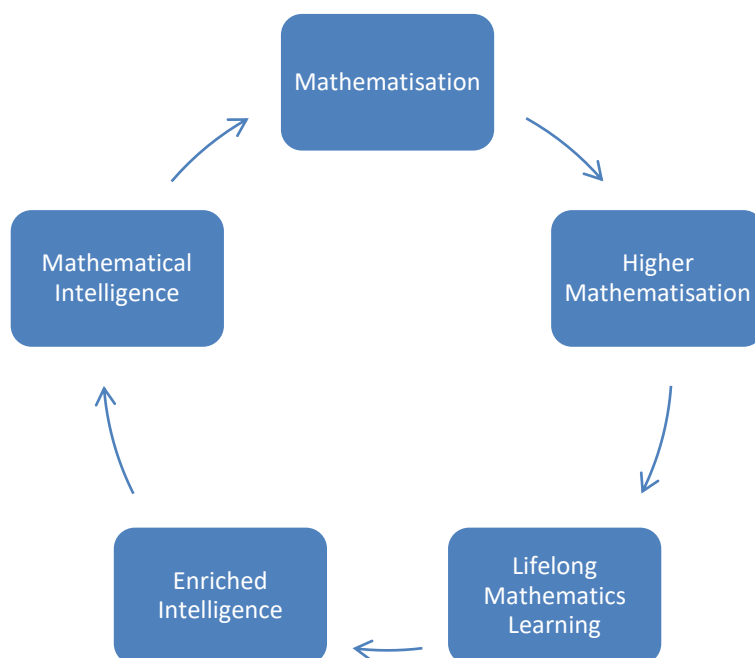


Fig 3: Mathematical Intelligence and Mathematisation Cycle

- This shows a **cyclical growth loop** where intelligence fuels mathematisation, and repeated mathematisation strengthens intelligence further.

Role of a Teacher in fostering Mathematisation and Mathematical intelligence among the students

- First and foremost, the teacher should be a facilitator to her students and shift her role from “Sage on the stage” to “Guide on the side.”
- Teacher should remove ‘Fear’ of Mathematics from the minds of the learners and should foster a positive attitude about learning Mathematics and assure them that it is not life threatening to talk or learn Mathematics.
- Everyone can learn Mathematics and it is not only for a chosen few – This mindset need to be developed in students.
- The teacher should create a learning environment that encourages exploration and curiosity in the learners.
- Teacher should shift the classroom culture from “getting the right answer” to understanding the process.
- Teacher should design tasks and world problems based on real-life situations, which require the students to mathematise the world around them.
- Open-ended and inquiry-based tasks should be assigned to students.

For example: “Create a rectangle with a perimeter of 24 cm. How many such rectangles can be made? Among them which rectangle has the greatest area?”

- Teacher should use visual aids, manipulatives, puzzles, games, technology and similar varied teaching strategies to stimulate thinking in the students.
- Teacher should build up the confidence in the students by motivating them, appreciating their efforts and help them realise that making mistakes is a part of learning.

For example, a teacher should say, “It’s okay if you don’t get the right answer right away.”

It's important how you understand and think of the problem”.

- Cross-disciplinary learning should be integrated. Encouraging students to apply mathematics in **science, arts, finance, or social studies** contexts promotes broader and richer mathematisation.
- A positive reinforcement and constructive feedback from the teacher help the students persevere in the face of challenges and understand their mistakes are learning opportunities for them.
- Collaboration with other subject teachers is essential to share best practices and resources.
- Teacher should use diverse strategies catering to the multiple intelligences and learning styles of the students in her classroom.
- Teacher should change the modes of assessments to examine students' mathematical abilities rather than procedural knowledge.

For instance, instead of posing close-ended questions or solving problems with direct application of formulae, a teacher should examine her students by assigning an open-ended task with multiple correct answers, ask them to create a word problem where a particular formula is used etc. This deepens conceptual understanding and critical thinking abilities in the learners.

- *STEAM example:* Use symmetry and proportion in art design. *Social science example:* Analyse population data or interpret election statistics.

Interrelation between Mathematisation and Mathematical Intelligence

1. Capacity vs. Process

- Mathematical Intelligence is the *capacity* to think logically and abstractly.
- Mathematisation is the *process* that channels this capacity into real-world problem-solving.
- Together, they act like the “engine and the road”—one powers, the other directs.

2. Mutual Reinforcement (Feedback Loop)

- Practising mathematisation tasks strengthens Mathematical Intelligence by improving

reasoning, abstraction, and pattern recognition.

- A learner with high Mathematical Intelligence can engage in deeper, more efficient mathematisation.

3. **From Potential to Performance**

- Mathematical Intelligence is a *latent ability*.
- Mathematisation is the *performance expression* of that ability in concrete or abstract tasks.

4. **Conceptual Understanding vs. Application**

- Intelligence ensures *deep comprehension* of concepts.
- Mathematisation ensures those concepts are *applied* meaningfully in daily life.
- Together they help students “understand + use” mathematics, not just “know” it.

5. **Creativity and Structure**

- Mathematical Intelligence brings creativity—finding multiple approaches to a problem.
- Mathematisation structures this creativity into models, equations, and proofs.

6. **Bridging School and Life**

- Intelligence helps learners grasp abstract knowledge taught in school.
- Mathematisation helps them connect that knowledge to life—budgeting, sports, architecture, coding, art.

7. **21st Century Skill Integration**

- Together, they align with NEP 2020 goals of **critical thinking, problem- solving, interdisciplinarity, and competency-based learning**.
- They prepare learners for real-world challenges—entrepreneurship, AI-driven jobs, data science.

8. **Balanced Learning Approach**

- If we focus only on Mathematical Intelligence → students may become “theoretical”

but struggle to apply.

- If we focus only on Mathematisation → students may handle real problems but lack conceptual depth.
- A balance ensures *both lifelong understanding and practical competence*.

9. Role of Lifelong Learning

- Intelligence ensures adaptability (learning new concepts).
- Mathematisation ensures transferability (using math in unknown, novel contexts).

“Mathematical intelligence and mathematisation do not work in isolation; they thrive on each other. Their **synergy** creates powerful learning experiences where raw intuition is shaped into structured understanding, and abstract concepts find life in real-world applications. The following examples illustrate this synergy in action.”

Real-life anecdotes - Examples of Synergy

- **Cricket Score Analysis** → Mathematical Intelligence: recognising patterns in averages & strike rate; Mathematisation: estimating run rate needed in the last overs. This is horizontal mathematisation, representing performance trends using graphs and algebraic modelling of strike rate is Vertical mathematisation.
- **Art, Culture and Design** → Mathematical Intelligence: Designing rangoli patterns using triangles, circles etc., recognising symmetry and spatial reasoning; Mathematisation : beautifully blending art, culture and mathematical intelligence to create structured patterns using geometric transformations.
- **Entrepreneurship** → Intelligence: logical planning of profits/loss; Mathematisation : developing a cost–benefit model with data representation.
- **Shopping** → *Ravi calculates whether two “Buy 1 Get 1” deals are cheaper than a flat 50% discount. Without realising, he’s applying ratio and percentage skills—an example of natural mathematisation supported by mathematical intelligence.*

Relevance in Current Educational Context

- Prepares students for the 21st century challenges and encourage inter-disciplinary thinking.

- Supports STEAM Integration and promotes entrepreneurial thinking skills.
- Aligning with NEP 2020 in India, which emphasises competency-based, critical thinking- oriented education.

To sum up, the two pillars—the **cognitive foundation (intelligence)** and the **practical application (mathematisation)**—are essential for cultivating **meaningful, relevant, and lifelong mathematical understanding**. Mathematisation is the application process of mathematics to real life whereas Mathematical intelligence is the cognitive strength to understand and work with mathematics. Together, they form the foundation of effective mathematics education for real-world readiness. Both these abilities complement each other. A student with strong mathematical intelligence can efficiently engage in mathematisation. Conversely, practising mathematisation can strengthen one's mathematical intelligence over time. As educators, especially teacher-educators, it is our responsibility to ensure that our learners—both students and future teachers—develop strengths in both the aforesaid areas. When mathematisation is encouraged and mathematical intelligence is nurtured, students learn not just mathematics, they learn how to think. That prepares students for real-world applications, well beyond exams.

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