

CHALLENGES AND OPPORTUNITIES OF ARTS-BASED SCIENCE LEARNING AMONG BASIC LEVEL STUDENTS AMID COVID 19 PANDEMIC

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Abstract

This paper provides an overview of the emergent practices of arts-based science teaching and learning in public schools in Nepal. It also shares why arts-based science learning has emerged as a shift in teaching and learning from a dogmatic approach to arts-based learning as well as the opportunities and challenges amid COVID 19 pandemic. QUAN-qual research method was applied in this research. The questionnaire survey was used to collect the quantitative data whereas an in-depth interview was taken to collect the qualitative information in this study. 300 students have been selected randomly out of 1300 study population by using the Raosoft sample size calculator with a 95% level of confidence and with a 5% margin error. It is found that the use of figures, posters, soil and sand art, songs and drama promote the understanding of students' science learning and their achievement score. The findings from this study are expected to encourage the Nepal government, local governments, and public schools to bring local practices into central level policies to transform the dogmatic approach to arts-based teaching and learning.

Keywords: *Arts-based learning, dogmatic approach, COVID 19, science learning*

1. Introduction

Arts-based learning refers to the purposeful use of artistic skills, processes, and experiences as educational tools to foster learning (Lutter, Pucino, & Jarecke, 2018). Arts-based strategies as those found in the arts, specifically literary, visual, music, songs, sand and soil arts and folk songs. It helps interaction, social presence, and a sense of cooperation that helps to encourage creativity among the students (Steele, Johnston, Lawlor, Smith, & Lamppa, 2019). It helps to build understanding among students, personalized interactions, and trust and promotes learner control (Steele, Johnston, Lawlor, Smith, & Lamppa, 2019). Arts-based learning strategies contribute to constructive student outcomes. Trends of science teaching and learning are increasingly moving from traditional lecturing to activity-based learning the process of re-inventing and re-creating some of the successful arts-based instructional strategies. The biggest challenge of adopting this strategy for online learning is ensuring effective instructional design principles are used in the adaptation (Pokhrel & Chhetri, 2021) and that the principles used are applicable to the design of arts-based learning (Meng, Hua, & Bian, 2020).

Arts-based science learning is based on a post-positivist research paradigm that favour the existing realities embedded within society. This paradigm provides a framework for conceptualizing science curricula and related educational research. Arts-based learning is emergent, imagined, and derivative from the perspective of science teachers for teaching and learning science.

2. Literature review

The value of the arts as teaching tools has long been recognized in face-to-face education (Torre et al., 2017). Specifically, art, photography, literature, poetry, music, and drama have been reported as contributing positively to the in-person classroom educational experience in arts-based teaching and learning. Stated outcomes of arts-based teaching strategies include reflection (Foong, Binti, & Nolan, 2018), creation of a safe learning environment, stimulation of dialogue, and student engagement in the affective domain (Bruno & Dell'Aversana, 2017). Arts-based instructional strategies are used in the schools in Nepal by the emergence of STEAM education by Kathmandu University. This technique of teaching and learning science increases the quality of interactions, enhances the sense of community, further application of course content, and helps learners to establish a group identity where ideas were respectfully shared and divergent perspectives admire (Perry, & Edwards, 2019). These reasonable, flexible teaching interventions enhance learning environments by encouraging creativity and risk-taking.

Furthermore, arts-based learning approaches humanize the online learning environment that students find socially isolating (La Velle, Newman, Montgomery, & Hyatt, 2020; Usher, & Barak, 2018). Maatuk, Elberkawi, Aljawarneh, Rashaideh, and Alharbi, (2021) argue that online learners sometimes feel disconnected from peers because of the separation of distance and time. To overcome this sense of separation, it is recommended that learning activities that promote learner collaboration and focus on cognitive and social-emotional learning outcomes are important. Such outcomes are achieved in part through the incorporation of arts-based activities (Perry, & Edwards, 2019). Adedoyin and Soykan, (2020) focus on the motivation that distance learners experience when they sense the human presence of their teachers and classmates resulting in a sense of community in an online classroom. In the same way, Mahyoob, (2020) attributes student motivation and commitment to learning in part to feelings of closeness and community among students learning. He further agreed that learning strategies that involve a sense of group and togetherness are essential as education moves from the traditional classroom to the arts-based learning. This learning approach is one way that the sense of humanness can be maintained as this transition occurs.

The COVID19 pandemic has affected more than 90% of the global student population, causing one of the largest disruptions in the history of formal education (Assunção & Gago, 2020; König, Jäger-Biela, & Glutsch, 2020). Even prior to the pandemic, one out of every five children, adolescents, and youth globally were out of school. Educational opportunities have long been unequally distributed across genders, income groups, geographies, and other demographic inequalities that have been worsened by the pandemic. Education in Nepal has been no exception to this trend. The unevenly developed South Asian nation of 28.6 million people has long dealt with structural challenges in delivering quality education to its population (Adedoyin & Soykan, 2020). Despite significant steps in education, almost half of the population still remains illiterate, a situation impaired by unequal socio-economic conditions and limited technological infrastructure. These pre-existing concerns have hindered the Nepali education sector's response to the global pandemic.

Despite such efforts, severe obstacles remain for Nepal's public education system. Not least of these is a lack of coordination between decision-makers at different levels of government. Nepal has been transitioning to a federal system from a unitary government since 2017, giving rise to new provincial and municipal levels of government. Despite the transition, many COVID 19 response decisions have been made by the central government, while local authorities have lacked the resources and institutional structure necessary to forge their own trails.

This study explores the answer to the following research questions that have an impact on discovering the challenges and opportunities of arts-based science learning for transformative pedagogy in the public schools in Nepal.

1. What are the opportunities for arts-based learning among basic level students in the public schools in Nepal?
2. How do students' opinions about the arts-based science teaching and learning amid COVID 19 pandemic?
3. What are the different perspectives of boy and girl students about arts-based science learning?

3. Methodology

Research Design

The design of the study adopted mixed-method research beginning with the quantitative and follow by a qualitative approach (QUAN→qual). This study uses a cross-sectional research design based on the mixed-method approach. This study used a qualitative approach to get inside into the existing issues and problems of arts-based science learning due to COVID 19 pandemic and a quantitative approach to get an overview by using questionnaire surveys. Finally, a qualitative approach was used to interpret the experienced phenomenon. Within the sequential research design, it used the emic approach to formulate an appropriate arts-based science learning framework based on the theory of change and the etic approach to generalize for quality assurance.

Study Area

The study area covers the basic level (grade 5-8) public schools of Kathmandu and Sindupalchowk districts.

Study Population

A total of 1300 students learning at the basic level in public schools of both the districts were the study population.

Study Sample

The simple random sampling technique was used for the quantitative data and a purposive sampling technique was used to collect the qualitative information from the study population. 300 students (150 boys and 150 girls) were taken as the study samples who are studying from grades 5 to 8 in the public schools in both the districts.

The sample size of the students for the study was derived by using the following formula.

$$n = \frac{m}{1 + (m-1/N)} \dots\dots\dots (i)$$

Where,

$$m = (Z/E)^2 P (1-P) D$$

Z=1.96, E=0.05, P=0.50, D=2 N= Study population

The study population for this study comprises students from grades 5 to 8 in public schools in Sindupalanchowk and Kathmandu districts.

For the qualitative study, in-depth interviews were taken with the students. All the interviews were transcribed and translated and then, together with the expanded conversation notes were analyzed using thematic content analysis (Acharya, 2020). Themes emerged from the data through a process of open coding and theme refinement without restricting the analysis by predefined codes and themes (Denzin & Lincoln, 2011). This process took place in three steps: open coding, categorization, and abstraction (Acharya, 2019). Firstly, data were transcribed from all semi-structured interviews and the first author performed an open coding using the software ATLAS.ti for qualitative analysis, searching the data for significant features relevant to our interest. Secondly, the first author noted the themes of the study. Thirdly, to refine the theme, the first author searched for relationships among the themes. Since all data were collected in the Nepali language, the data analysis was performed in Nepali. During data analysis and write up of the manuscript, the original Nepali quotes were used as much as possible to prevent loss of meaning as a result of translation. The quotes in the final manuscript were translated by the first author and checked by the language expert.

Result and Discussion

The result of the study showed that the use of arts-based learning in basic school science learning is beneficial. It shows that the mean score for arts-based science learning was 3.49 (SD 0.864) (Table 1).

Table 1: Use of arts-based teaching and learning science

N	Mean (SD)
300	3.49 (0.864)

Regarding the arts-based science learning in the basic level schools in Nepal, 22.7% of the students were undecided or they do not know, 14.7% of them disagreed and 62.6% agreed to use posters and figures in teaching science during COVID 19 pandemic. 30.0% of students were using figures printed on the books, 132 students i.e., (44.0%) of them had used posters and 12 students i.e., (12.0%) of them were using soil arts during teaching and learning science during the midst of the COVID 19 pandemic. The level of awareness among students to use arts-based science learning was (80.2%).

Table 2: Application of pictures for arts-based learning in basic level science

Arts-based learning	Boys	Girls	Total	P-value
	%	%	%	
Agree	64.0%	75.4%	67.0%	< 0.001
Don't know	24.24%	14.5%	22.0%	
Disagree	11.6%	8.7%	11.0%	
Total	100.0%	100.0%	100.0%	

It is found that most of the students (67.0%) were aware and agreed to use arts-based teaching and learning whereas only 33.0% of them disagreed with it (Fig. 1). Girls students were agreed more than boys use arts-based learning during the midst of the COVID 19 pandemic ($p < 0.001$) (Table 2).

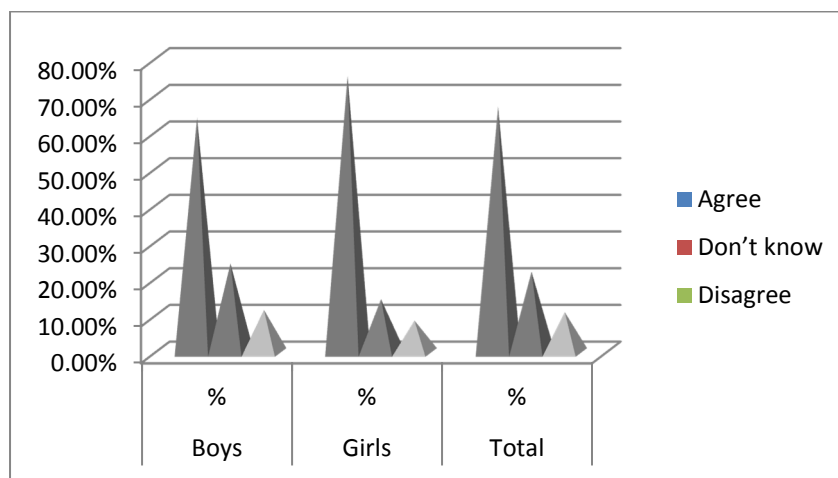


Figure 1. Application of Picture for Arts-based Learning in Basic Level Science

This result was triangulated through qualitative data. Four girl students during in-depth interviews said in favour of the quantitative finding (Table 2).

We are happy to learn science online. Teachers facilitate us to do project work. As project activities, we used soil in the periphery of our house and draw figures using soil particles. Sometimes, we draw figures on the soil as well. Most of the time, we look at figures given in the textbook and practice drawing. Time is saved due to online classes. Two hours of time in a day are saved due to COVID 19 pandemic that is used to practice our work. This becomes an opportunity for us due to lockdown and COVID 19 pandemic (Girl students, in-depth interview, 2021).

This qualitative finding was similar to research done by many researchers. Consistent with it, Sefton-Green, Thomson, Jones, and Bresler, (2011) said that arts-based teaching and learning help to develop creativity among the students. In the same line, Bradley, Moore, Simpson, and Atkinson, (2018) argued that collaborative learning is beneficial for developing science process skills through arts-based learning. Conceptualizing arts-based learning in the early years is important to develop life skills among the students (Nutbrown, 2013).

Science learning from the poster was one of the techniques of arts-based learning in this study (Fig. 2).

Table 3: Learning science from posters at the basic level public school

Learning from poster	Girl students	Boy students	Total	X ²	P-value
	%	%	%		
Agreed	59.5%	69.5%	66.0%	12.6	0.013
Don't know	26.2%	19.7%	22.0%		
Disagreed	14.3%	10.8%	12.0%		
Total	100.0%	100.0%	100.0%		

It is found that more girl students (69.5%) agreed than boys (59.5%). Out of 300 students, 66 students (22.0%) did not have any idea of learning from the poster in teaching and learning science. Only a very few (12.0%) students disagreed with the use of posters in science classes in the basic level public schools in Nepal.

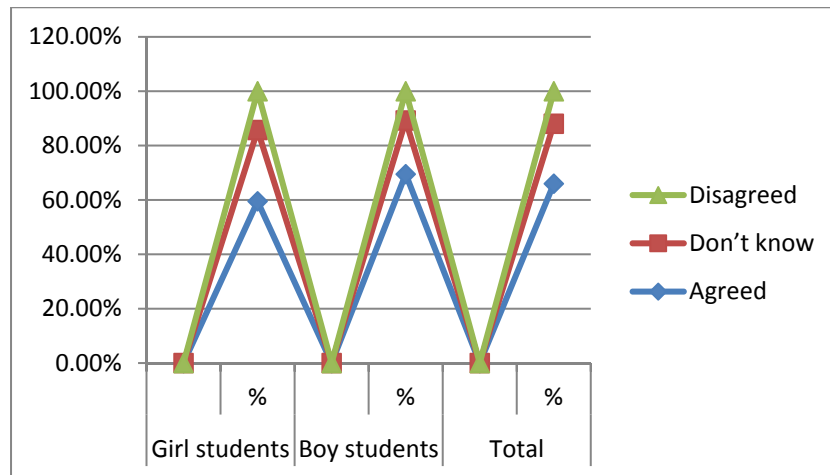


Figure 2. Learning Science from Poster at the Basic Level Public School

In relation to this finding, boy students argued:

Learning science through posters is not applicable because COVID 19 pandemic confines us within our houses. Due to lockdown, we are unable to move around and this learning through the poster is adversely affected by the pandemic (Boy student, in-depth interview, 2021)

Furthermore, one of the girl students opinioned as

Science learning is possible through practical activities. Science apparatus is not available in homes. So, how it is possible to learn science through hands-on activities? I found learning through posters difficult. Further, I get afraid when I am out of my home. Is it possible to learn science from the poster in this situation? I think, not! I claim that COVID 19 pandemic has adversely affected learning science (Girl student, in-depth interview, 2021).

In favour of the finding, COVID 19 pandemic is adversely affected to develop of science process skills (Carrillo, & Flores, 2020). In the same way, Moorhouse, (2020) researched that face-to-face instruction was required to be delivered exclusively online due to the suspension of face-to-face classes caused by the COVID-19 pandemic. It describes the challenges faced by adapting to the new mode of delivery. Furthermore, Moorhouse found that students can learn from experience and prepare for the suspension of face-to-face classes caused by the COVID-19 pandemic.

Table 4: Relation between COVID 19 and arts-based learning

Arts-based learning	Boys	Girls	Total	X ²	P-value
	%	%	%		
Agree	54.0%	93.0%	67.0%	7.00	0.136
Disagree	31.0%	4.0%	22.0%		

Don't know	15.0%	3.0%	11.0%
Total	100.0%	100.0%	100.0%

Table 4 shows that more than 50% of boys at the basic level of science were adversely affected by COVID 19 for the study based on arts-based learning. 93% of girls agreed that they were adversely affected by the pandemic for science learning due to COVID 19 (Fig. 3).

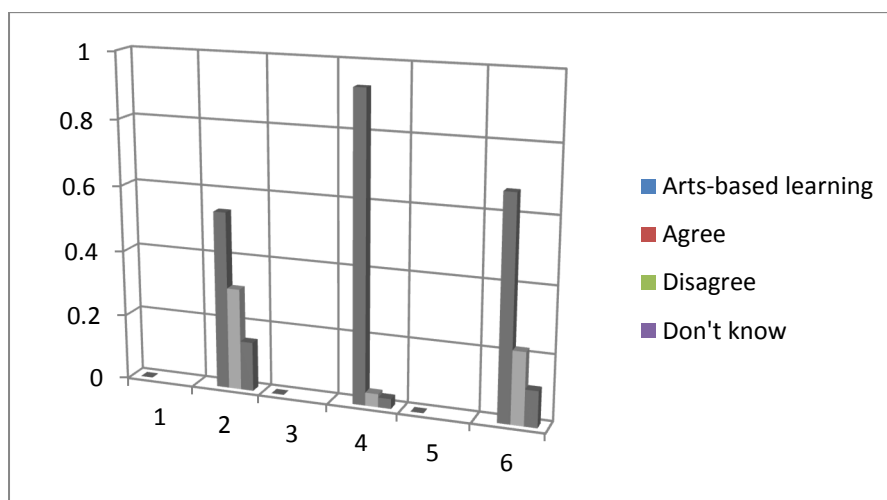


Figure 3. Relation between COVID 19 and Arts-based Learning

Pre-test and post-test has been taken before and after the arts-based learning among the study population. The pre-test score shows that there is no significant difference in the achievement of boys and girls taught by not using arts-based learning (Table 5).

Table 5: Pre-test score of boy and girl students without using pictures

Gender	Sample size	Mean	Std. derivation	variance	t-value	Significance (two-tail)	df	Remarks
Boys	150	22.90	7.14	50.97	0.91	0.37	21	0.37>0.05
Girls	150	20.53	5.33	28.25				

Table 5 shows Levine's test of equality of variance between post-test scores obtained by the overall boy and girl students taught by arts-based learning. The difference in achievement score of boy students taught by arts-based learning method ($M = 22.90$, $SD = 7.14$ and $V = 50.79$) and girl students were ($M = 20.53$, $SD = 5.33$ and $V = 28.25$) with conditions; $t(21) = 0.910$, $p = 0.373 > 0.05$. Since the calculated p-value is greater than the standard p-value of 0.05, it indicates that there was no significant difference in the achievement of boys and girls in the post-test scores.

Table 6: Post-test score of boys and girls students by using pictures

Gender	Sample size	Mean	Std. derivation	variance	t-value	Significance (two-tail)	df	Remarks
Boys	150	29	3.46	11.97	1.08	0.31	8	0.31>0.05
Girls	150	25.66	6.66	44.35				

Table 6 shows Levene's test of equality of variance between a post-test score of boys' and girls' students taught by arts-based learning. This is analyzed through the use of an independent sample t-test. The difference in the achievement score of experimental group boys (M = 29.00, SD = 3.46 and V= 11.97) and experimental group girls (M = 25.66, SD = 6.66 and V= 44.35) with conditions, $t(8) = 1.08$, $p = 0.31 > 0.05$. Since the calculated p-value is greater than the standard p-value of 0.05, it indicates that there was no significant difference in achievement scores of boys' and girls' students in post-test scores by using pictures.

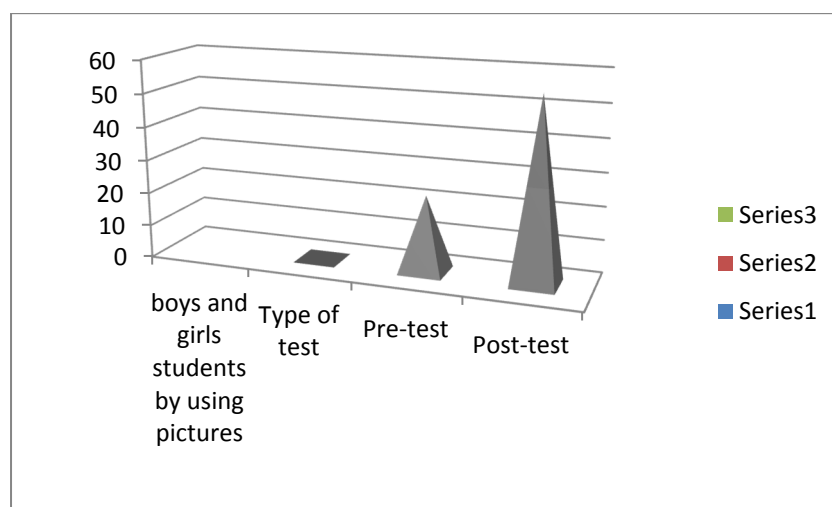


Figure 4. Pre-test and Post-test Score of Students by using Picture

Table 7: Pre-test score of boys and girls students using posters

Gender	Sample size	Mean	Std. derivation	variance	t-value	Significance (two-tail)	df	Remarks
Boys	150	28.25	3.38	11.42	0.93	0.36	21	0.36>0.05
Girls	150	26.63	4.82	23.23				

Table 7 shows Levene's test of equality of variance between the analysis of pre-test scores obtained by overall boys and girls students taught by using posters. The difference in the achievement score of experimental group boys (M = 28.25, SD = 3.38 and V= 11.97) and experimental group girls (M = 26.63, SD = 4.82 and V= 23.23) with conditions; $t(21) = 0.935$, $p = 0.360 > 0.05$. Since the calculated p-value is greater than the standard p-value of 0.05, it indicates that there was no significant difference in achievement scores of boys' and girls' students in pre-test scores by arts-based learning. Result (Table 7) shows that the achievement score obtained by the experimental group of boys in science does not significantly differ from the achievement score obtained by the experimental group of girls in science after treatment.

Table 8: Post-test score of boys and girls students using posters

Gender	Sample size	Mean	Std. derivation	variance	t-value	Significance (two-tail)	df	Remarks
Boys	150	14	4.41	19.45	0.09	0.93	11	0.93>0.05
Girls	150	13.75	4.83	23.33				

Table 8 shows Levine’s test of equality of variance between pre-test scores obtained by a collaborative group of boys and girls. This is analyzed through the use of an independent sample t-test. The difference in the achievement score of boys (M = 14.00, SD = 4.41 and V= 19.45) and collaborative group girls (M = 13.75, SD = 4.83 and V=23.33) with conditions; $t(11) = 0.094$, $p = 0.927 > 0.05$. Since the calculated p-value is greater than the standard p-value of 0.05, it indicates that there was no significant difference in the achievement of pre-test scores in science between the boy and girl students.

Achievement of students in post-test shown well by the use of posters in teaching and learning science (Fig. 5).

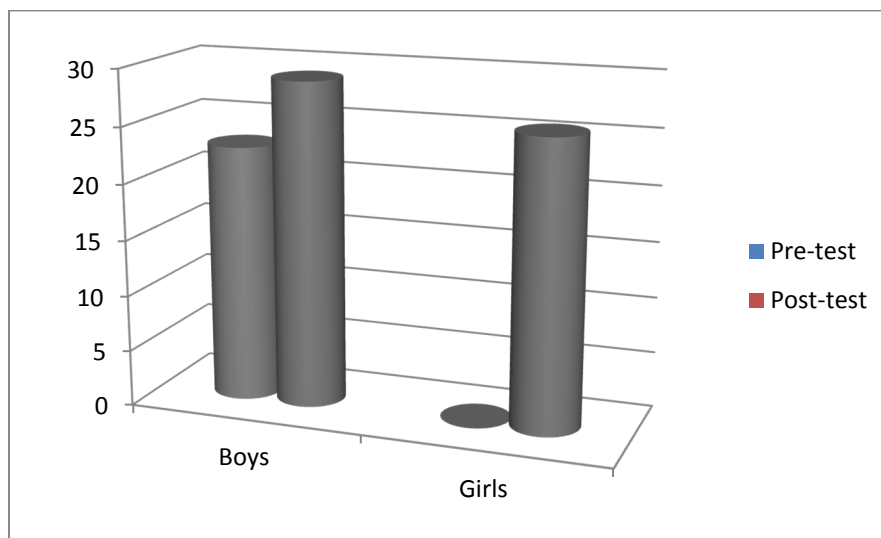


Figure 5. Pre-test and Post-test of Boys and Girls using Posters

Table 9: Correlation between overall students' performance in a pre-test score and post-test score using arts-based learning

Score		Pre-test score	Post-test score
Pre-test	Pear Pearson correlation (2-tailed)	1	0.739
			0.000
Post-test	Pearson correlation (2-tailed)	40	40
		0.739	1
		0.000	
		40	40

Table 9 shows the correlation between achievement scores of students in pre-test and post-test taught by using arts-based learning. A Pearson product-moment correlation coefficient was computed to assess the relationship between pre-test and post-test scores of the students in science. The Pearson

correlation(r) = 0.739, n = 40, p = 0.000. Since the Pearson's was 0.739, This study shows that there was a high positive correlation between the achievement of pre-test and a post-test scores of all students in science.

Table 10. Correlation between pre-test scores and post-test scores of students in an arts-based learning

		Pre-test score	Post-test score
Pre-test score	Pearson correlation	1	.820**
	Sig. (2-tailed)		0
	N	23	23
Post-test score	Pearson Correlation Sig. (2-tailed)	.820**	1
		0	
	N	23	23

** . Correlation is significant at the 0.01 level (2-tailed).

Table 10 shows the correlation between achievement scores of pre-test and post-test obtained by students taught by arts-based learning. A Pearson product-moment correlation coefficient was computed to assess the relationship. The Pearson's correlation(r) = 0.820, n = 23, p = 0.000. Since Pearson's correlation value (r) was found to be 0.739, this study shows that these two variables are positively correlated. It indicates that there was a high positive correlation between achievement scores of pre-test and post-test scores of students taught by arts-based learning (Fig. 6).

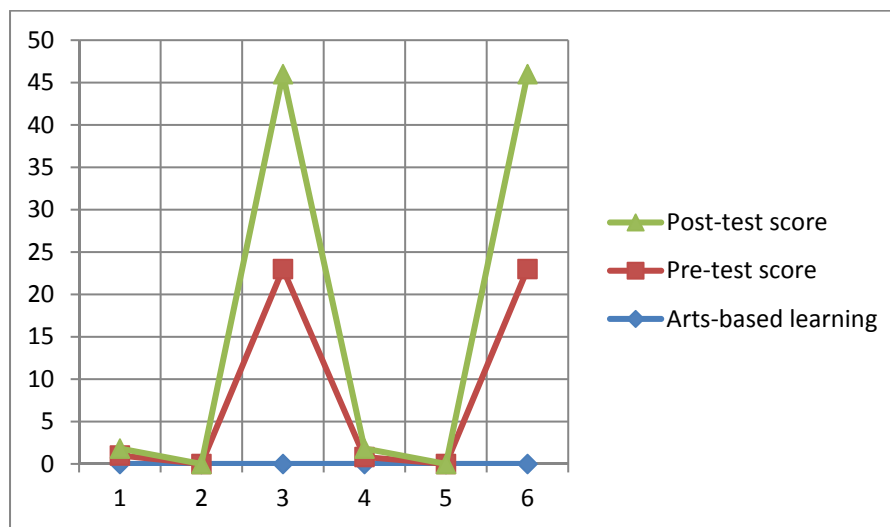


Figure 6. Correlation between Achievement Score of Pre-test and Post-test obtained by Students Taught by Arts-based Learning

Triangulating the results of the quantitative data, in-depth interviews with the students show the following findings.

Arts-based science learning is good to understand the basic concept of science at the basic level. It is an approach that fits in villages and city areas because contextual learning is possible in this approach. Here (at Sindupalanchowk) soil and sand art as well as poster making are the best way of arts-based learning (student 2, in-depth interview, 2021).

In the same line, another student argued:

Girls learn more through the use of posters and figures in science learning activities. I cannot understand chemistry through the use of arts-based learning like songs, drama and posters. Chemistry needs recitation to understand. But, girls learn chemistry from poetry (Boy 4, in-depth interview, 2021).

Similarly, a girl student in the in-depth interview said:

...science is one of the practical-based subjects that can be learned from activities. Many topics of biology and a few contents of physics can also be taught through arts-based learning activities. Lessons like natural resources, environmental balance, solid waste management, and environmental hazard can be learned from the posters and figures (Girl 2, in-depth interview, 2021).

The present study's contribution is to show the students' perspectives on arts-based science learning. The finding of the present study is in line with Nguyen, Miranda, Lapum, and Donald, (2016) arguing that the use of arts-based learning is necessary to transform dogmatic learning into arts-based learning. Similarly, Burnard et al., (2018) noted that the art of co-creating arts-based possibility spaces for fostering STE(A)M practices in primary education is positive.

Furthermore, it is found that students learn more through arts-based science learning. This finding is in line with Barone, (1995), who put forward the importance of knowledge transfer through pictures and posters as an activity for learning science. Barone further argues that songs and drama also help to learn science through arts-based learning. Also, Froggett, (2007) researched that arts-based learning assures justice among the learners.

Limitations and Recommendations

There are limitations to this study. First, because of time limits, only six in-depth interviews were taken with the students in relation to the arts-based science learning and the challenges of the COVID 19 pandemic. This research article relates a small part of the

Small Research, Development and Innovation Grant (Small RDI Grants) from the University Grants Commission. We hope that this study can act as an invitation to other Nepalese public schools' science teachers, the Ministry of Education, researchers in relevant fields, relevant organizations, and policy-makers to engage in public discussion about the current practices and reforms in schools in Nepal that aim to shift classroom pedagogy towards arts-based learning. We also hope that such open discussions can lead to a new paradigm of arts-based science learning to transform the entire pedagogical orientation in science in all the public schools in Nepal. Recommendations include further research involving music as a part of arts-based learning addressing more study population, their experiences, insights, and reflections.

Research Ethics

Consent was given to involving research participants in the study and it was expected that they would not be exposed to any significant risks. Furthermore, throughout the in-depth interviews, it was emphasized that 'research participation was voluntary' (Acharya, Budhathoki, Bjønness, & Jolly, 2020) and that the participants were free to withdraw from the study at any moment without having to provide reasons or face any consequences.

Acknowledgements

We would like to thank the students who have provided time and valuable insights to us by participating in the study. This paper has been prepared with the support from the Small Research,

Development and Innovation Grant (Small RDI Grant), University Grants Commission entitled ‘Arts-based Science Learning for Transformative Education: A Study on Public School Students’ with award number SRDIG-77/78-Edu-04. We would like to thank the University Grants Commission for the award.

Author’s Contribution

KPA and SK collected data. KPA transcribed, translated, interpreted the data, and drafted the manuscript. MA provided scholarly guidance and corrected the manuscript. All the authors read and approved the final version of the manuscript.

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