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Exploring Science Learning through Arts-based Sketches and Photos: A Transformative Paradigm

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Abstract

The study reconnoiters arts-based learning by the use of sketches and photos of basic-level students and science teachers. It was accompanied in the basic level public schools of Kirtipur municipality of Kathmandu district. The study explores how the use of sketches and photos promotes students' science learning and also designs an appropriate strategy for engaged learning. A qualitative research design was used based on the interpretive paradigm in which data are collected through in-depth interviews and focus group discussions. The data were analyzed through verbatim and thematic approaches. The study found that the use of arts-based learning like sketches and photos helps to learn science that develops creativity and communication. It was also found that science teachers used sketches and photos linked to the prescribed curriculum while teaching and learning science. It is recommended that the application of sketches and photos would be beneficial for science learning. For this, science curricula and textbooks have to incorporate the techniques of arts-based conceptual learning in the public schools in Nepal.

Keywords: Engaged learning, photos, sketch, transformative paradigm

Context

Learning science in the schools of Nepal is dictation-based (Acharya, Budhathoki, Bjonness, & Devkota, 2022). Most of the science teachers in the basic level public schools in Nepal apply the Vedic education system in which the students are passive listeners (Acharya, Budhathoki, & Acharya, 2022). Researches show that the average student's achievement score is

below the national standard [Education Review Office (ERO), 2013; 2015]. To improve the learning and achievement of students in science, an arts-based approach is one of the techniques. Using the available resources in the local context, arts-based science learning engages students meaningfully in learning science (Hitchcock, & Onwuegbuzie, 2022). Arts-based science learning in the schools of Nepal is the initiation of Science, Technology, Engineering, Arts, and Mathematics (STEAM) education. The use of sketches and photos helps to develop artistic abilities to learn science (Erol, Erol, & Başaran, 2022; Salmi, Thuneberg, & Bogner, 2020). The application of sketches and photos in science classes helps set up a natural setting of cooperation among friends, develops a cooperative learning environment, and creates a space for thinking (Powell, & Aram, 2020). This technique of learning also helps to connect the subject matter with evidence through mental exercise (Moreau, & Chou, 2019). Also, this practice promotes teachers, which positively influences encouraging motivation. Further, the use of sketches promotes students' learning outcomes that are far better than the conventional model (Pauwels, & Mannay, 2019).

Further, this study tries to explain why engaged learning through the use of sketches and photos is important and how it is useful to public schools attempting to implement transformative pedagogy. The majority of public schools in Nepal, according to Khanal, Perry, and Park, (2020), are characterized by poor teaching practices, teacher and student absenteeism, a lack of qualified and committed teachers, a lack of teaching-learning materials, and poor infrastructures. Also, the research delays and even the non-availability of textbooks and laboratory facilities. Engaged learning through the use of sketches and photos is linked to Science, Technology, Engineering, Arts and Maths (STEAM) education. Among the numerous engaging and learner-centered pedagogies used by teachers, use of the photos and sketches for learning science is one of the best methods. Through the use of photos and sketches for science learning, there are more focused on the activities of the students where they participate in the planning, designing, and implementation of real-world settings. Students develop the habit of critical thinking, decision-making, creativity, curiosity, and problem-solving skills through the use of arts-based techniques like use of sketches and photos (Graesser et al., 2018; Lombardi et al., 2021; Sk, & Halder, 2021; van Laar et al., 2020).

Engaged learning through the use of photos and sketches is a teaching and learning method in which students investigate different concepts, ideas, and solutions in the context of a real-world problem and challenge (Douglas, & Jaquith, 2018; Haut et al., 2018; Ren et al., 2021). It is simply a technique of learning; it's also a way of cooperation and collaboration through which students develop the habit of thinking beyond textbooks and ready-made notes. Students who learn to take responsibility for their own learning will lay the groundwork for how they will collaborate with others in adulthood. So, learning from photos and sketches is an excellent way to apply STEAM knowledge to a real-world problem.

The use of sketches and photos is a learning paradigm in which the teacher thinks beyond the text written in the book. It is based on the transformative approach of learning that does not seek to replace the pragmatist learning that focuses on engaged learning through experimentation. This approach shifts science teaching from textbook-centered to science exploration. Students and teachers concentrate to achieve high scores in the examination in the traditional set up whereas engaged learning and critical analysis are possible in arts-based classrooms. Teaching and learning culture can be transformed through an arts-based paradigm in the schools of Nepal. To favour this statement, (Hora, Benbow, & Smolarek, 2018) argue that science learning through sketches and photos supports facilitating students and teachers for collaborative learning by setting a non-formal and creative environment. The purposive drive of this study is to bring forth the transformative paradigm of learning by the use of sketches and photos for science learning. The main objective of this study is to explore the perceptions of students and science teachers to learn science through the use of sketches and photos to shift learning from the traditional lecturer method into engaged learning.

Method

A qualitative research method based on interpretative inquiry is used in this study. According to Rowland (2021) interpretative inquiry emphasizes accepting the values, determinations, and intents (elucidations) students give to their own engagements and communications with others. The population of this study was the basic level public schools, science teachers, and students. The research site was the Kirtipur municipality of Kathmandu metropolitan city. A purposive sampling method was used for the study as

this sampling technique is a type of non-probability sampling technique in which entities are nominated because they have physiognomies that the researcher needs as a sample. In-depth interviews and focus group discussions were used to collect the data. Collected data were coded and analyzed using verbatim and thematic analysis. The data were then transcribed as the initial ideas of the interview and FGDs. The final theme emerges by collecting all the data and codes relevant to each potential piece and reaching on conclusion.

Findings

It is found from the study that the use of photos and sketches in arts-based science learning is an innovative way of looking and understanding both the emotions and intellects of students in the basic level schools. Students were enjoyed while talking about the learning science from sketches and photos. This transformative technique of pedagogy developed artistic skills like acting, drawing, and writing among the students. Students were fearless in the class as this approach of learning provided opportunities for engaged learning and developing the skills of collaboration and cooperation.

Engaged learning through the use of sketches and photos is a technique for each student to develop the habit of brainstorming. It is a powerful tool for visualizing information as it enters and exits the brain. It is an essential tool for taking notes and brainstorming on the topics of science. It was also found that students started to divide the piece of paper into four equal halves by drawing two lines and writing the definition, characteristics, and example of content in each box. Regarding the perceptions of science teachers on arts-based learning, it is found that school science textbooks lack exercises related to music, drama, and arts for learning. Concepts of science can be learned through the engagement of students like playing, drawing, dancing, and involving in activities. Through visual maps and arts, children learn the content of science, processes, and techniques.

It is also found that sketches and drawings related to science content help to develop skills that is linked to previous knowledge of students. Science teachers said that motivating and providing students with hands-on activities provide authentic and divergent thinking. Arts-based techniques like the use of photos and sketches help students to share their ideas with

peers, collaborate with them, and understand peer work as a part of the learning experiences. It is also found that the integration of arts like photos and sketches delivers numerous techniques for students to promote logical reasoning. The techniques of the use of photos and sketches help to visualize the clear concept of the content. It is also found that the use of photos and sketches in the class motivates students to learn. Students learn without fear and with fun from this learning approach. Moreover, they understand the biography of scientists, some investigations, and inventions. They can study nature and the natural sources, their formation and conservation as well.

This study also found that both the teachers and the students have knowledge of using pictures and photos. Arts-based instructional approaches contributed to the teachers' perceptions of teaching and learning in a positive way. In the other side, only engagement cannot promote arts-based learning and this to promote and apply theoretical knowledge into practical aspect of life. In relation to the sketches and photos and science learning, one of the teachers said photo of scientists, flowers, animals, birds, or any other natural scene related to the science curriculum plays an important role to impart knowledge. However, the use of photos is not applicable in all the chapters of science. The use of photos is more important and related to teaching the concept of biology and related content. Further, regarding the use of photos for teaching and learning, it was found photos are the expression of human creativity and perception. There are different types of photos such as paintings and sketches. These techniques of STEAM pedagogy promote learning differently from the traditional lecture method. Drawing is generally a human activity that involves the expression of aesthetics, feeling, or ideas. It is a transformative learning paradigm.

Regarding the use of sketches in science learning, one of the teachers said that learning is the change in behavior brought about by skills from engaged learning. A sketch is a rich approach that emphasizes conceptual skills and helps transform the education system.

Drawing diagrams in science can be used in nearly every aspect of science. The major reason for using drawings and sketches in science class is for developing skills of observation (for example, the pupa stage of a mosquito, the tadpole of a frog, etc.). Observation may be related to the

moment of force as the handle of a door is fixed on the edge but not in the middle or side. When students are engaged in sketching in a science class, they develop higher-order skills like synthesizing, evaluating, and creating. This transformative technique of learning is fun for the students and develops the power of collaboration. It was found that drawing sketches of parts of flowers, body parts of a grasshopper, and drawing the planets in the solar system develop social skills among the students.

From this study, it is also found that photos and sketches of scientists help to understand more than the words written in the book. It promotes creativity, collaboration, scientific literacy, innovative capacity and helps to understand abstract ideas of a different scientific concept. Also, it developed the skills of communication. Another interesting finding from this study was the conceptual clarity of the classification of elements, classification of animals and plants, life cycle, flowering and non-flowering plants, living and non-living things, the periodic table, reproductive system, sense organ, digestive system, solar system, eclipse, water cycle, ecosystem, etc. In this line, the science teacher said teaching using poster helps to draw students' attention to read. Teaching using posters arouse curiosity among the students about posters. It also makes learning easier for the teacher to explain the subject. Students can remember for a long time what they read from the poster.

Teaching through the poster involves active participation of students in learning, and provides students with the opportunity to learn. As the poster displayed during teaching is colorful and attractive which makes the learning environment more effective. By using posters during teaching, students get the opportunity to learn fun. Students can quickly recall what was read by the poster as a part of STEAM pedagogy.

From the study, it is found that issues arising in the class and providing time to think and write are major strategies for engaging students in arts-based learning. It is also found that topic discussion, think, pair and share and also to motivate students to share ideas are the techniques of arts-based learning. Regarding the findings related to the strategies of the use of photos and sketches for science learning, it is found that showing video clips related to the teaching contents, displaying photos, use of posters and sketches, etc. are the techniques of arts-based science learning. Similarly, it is found that issues arising in the class and providing time to think and write are the

major strategies for engaging students in arts-based learning. It is also found that topic discussion, thinking, pairing, and sharing and also motivating students to share ideas are the techniques of arts-based learning. Regarding the promotion of arts-based learning, it is found that encourages students to draw, label, discuss, share ideas, and present in small groups. Such activities make students happy and feel free to do their own tasks and they behave as scientists do. This is the most interesting finding of this study.

Furthermore, the use of photos and sketches are the visual strategies to promote effective teaching and learning. It minimizes the anxiety of students through the use of video and pictures in class. Also, it is found that science teachers need to apply think pair share strategy as students think about an issue and share with friends in the class. Also, provide an opportunity for quick writing in which students have to write a few points, keywords or sentences related to the topic. Further, it is found that link the previous knowledge of students links the basic concept with the present teaching and learning topic. It is also found that providing students a regular opportunity to share their thoughts and demonstrate learning in the class that drive for the engaged learning which is a transformative paradigm of STEAM education.

Discussion

The main finding of this study was the use of sketches and photos are better for science learning. Similar to these research findings, Wiley, (2019) sketches are more relevant to the study than photos. In the same line, Guo et al., (2019) said that reflecting on feelings and recognizing the value of photos for earning is one of the strategies. Consistent with this finding, Mitchell, Ratcliffe, and LaConte, (2020) said that effective professional development required a blend of teacher knowledge and experience with research-based strategies, reflecting a growing number of reform initiatives that viewed teachers' knowledge as integral to changing schools. Similarly, Wiley, (2019) said that the use of sketches and photos in arts-based learning is a more powerful pedagogic engagement strategy to learn science. Similar to this finding, another research said that students' engagement in drawing and sketching related to science content is one of the techniques of arts-based STEAM pedagogy (Roche et al., 2021).

Moreover, assenting to this research finding, Stahl et al., (2022) found that science-related sketches and photos are the techniques to engage students in the class for developing creativity. As the aforementioned, engagement was significantly and positively associated with the students' achievement through arts-based learning (Guo et al., 2019). Similar to the finding, examining how science classrooms promote students' engagement in the classroom is determined by the use of students' creativity through the application of sketches and photos (Yildirim, (2021). Also, Mitchell, Ratcliffe, and LaConte, (2020) researched that STEAM strategies are powerful tools and techniques of science learning. These help for increasing students' engagement and participation in the learning process. Furthermore, arts-based learning is possible through the meaningful engagement of students. This finding is consistent with the research carried out by Yildirim, (2021) explaining, exploring and evaluating are the main steps for the students' engagement in arts-based learning.

Furthermore, it was found that knowingly or unknowingly public-school science teachers use strategies of arts-based learning like photos and sketches related to the curriculum. They used posters, pictures, and charts as a part of teaching and learning science subject. But they felt difficult to connect these activities with the curricular goals and daily life activities of students through students' engagement. This finding of the study is more relevant to the study done by Finley, (2011) found that arts-based science learning is an innovative way of looking at and understanding both the emotions and intellects of students. In the same line, another research found students enjoy talking about learning science from the picture and posters (Patrick, 2016). Also, it developed artistic skills among the students (Sinner et al., 2006). Sketches and drawings related to science content help to develop skills that are linked to previous knowledge of students (Doyan, Susilawati, & Hardiyansyah, 2021). Arts-based learning help students to share their ideas with peers, collaborate with them, and understand peers' work as a part of the learning experiences (Hira, & Anderson, 2021). The use of photos and skethces motivate students to learn in a creative way (Lopez-Pellisa, Rotger, & Rodriguez-Gallego, 2021). Another study also said that students learn without fear and with fun by adopting the approaches of arts-based learning (Farag, 2021). Students can study nature and natural sources, their formation, and conservation techniques from arts-based techniques like sketches and photos (Hira, & Anderson, 2021; Farag, 2021).

Furthermore, the finding of the present study in relation to the students' engagement with an arts-based technique like the use of photos and sketches is in line with Prafitasari, Sukarno, and Muzzazinah (2021) arguing that the use of pictures and figures in the form of arts in the classroom help students to learn abstract ideas in an easy way. Similarly, Farag (2021) noted that the impact of arts-based learning increases the academic outcomes of students in science which can be supported by digital technologies on language expression. A study done by Rasmussen, Ostergaard, and Glaveanu (2019) argued that creativity increases among learners through the use of drama, arts, and pictures in the classrooms.

On the same line, Varclas et al. (2022) found that activity-based learning through the use of arts in the class increases students' participation and engagement. Similarly, Santi, Gorghiu, and Pribeanu (2022) claim from their research findings that students' engagement and active participation are possible through arts-based learning even during a difficult situation. In the same line, Ostergaard, and Glaveanu (2019) argued that empowering students to play, work and learn through the use of pictures enables them to develop competencies to build collaborative groups capable of applying skills for learning science.

Furthermore, it is found that science teachers agreed that effective implementation of photos of scientists in science classes really supports students' interest to learn (Yildirim, 2021). This argument is in line with Farag (2021) that poster in the class makes learning lively. Live discussion supports students' learning. It is also found from the study that the development of life skills plays an important role in students' life that can be achieved through demonstration (Doyan, Susilawati, & Hardiyansyah, 2021). The finding of the present study supports Prafitasari, Sukarno, and Muzzazinah (2021) ideas that developing life skills helps to ensure meaningful learning. These views of the teachers clearly show that the use of photos and sketches engages students in learning which facilitates them to learn.

Authors' Contributions

KPA collected data, interpreted and drafted the manuscript. MA thematically analyzed the verbatim of students and teachers in relation to arts-based learning through the use of photos and pictures.

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No potential conflict of interest was reported by the authors.

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