

STEAM Approach: A review of Google Earth tools in teaching and learning of Science subject to inculcate Project-Based Learning

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Abstract: The STEAM approach has emerged as an effective way to project-based learning in education with the help of Google Earth Tools. This study intends to inculcate, STEAM approach project-based learning, the current learning style in the field of digital literacy if the use of Google earth tools can lead to significant gain among teachers and students, and in what ways. This study aims to analyze stakeholders' perception of the Google earth tools, its implication of students' and teachers' understanding of the 21st Century skills, Sustainable Development Goals mentioned in NEP 2020 and if significant improvement in inculcating project-based learning among students and teachers exist and can be measured. This article evaluates the use of Google Earth Voyager and creation tools in education for teaching and learning. Google Earth tools enhance STEAM education and digital literacy among students and teachers. It continues the dissemination of innovative pedagogical approaches like STEAM Project-Based Learning Challenge Based learning as well as supporting cognitive skills by equally supporting language practice. Using qualitative and quantitative data collection, this paper examines whether or not the implementation of the use of Google earth tools resulted in the gaining of STEAM Project-Based learning and positive interest in learning about the curriculum. Pre and post-tests were used to evaluate the effect of Google earth tools using the STEAM approach on teachers' and students' achievement. Collected data of various training of STEAM approach using Google earth tools training were analyzed by the researchers and authors of this article. The results showed an increased level and shall help the policymakers to choose the best criteria for inculcating STEAM project-based learning in the schooling system. This paper discusses the background of the project and aims to draw inferences and conclusions based on the data gathered from the implementation of the Google earth tools using the STEAM approach in Nashik, Pune, Mumbai districts during the year 2019-20 and 2020-2021.

KEYWORDS: 21st Century Skills, Digital Literacy, Google Earth tools, NEP 2020, Project-based Learning, STEAM, Sustainable Development Goals.



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I. INTRODUCTION

This paper is designed as an exploratory review of a Google Earth Tools using STEAM approach teaching experiment in which two groups were involved in making innovative projects virtual exposure using the manual process of project making (Manual and Google earth tool) facilitated by Zoom Cloud meeting. The authors of this article are the researchers and instructors of the two project-based teaching methods involved in the teaching.

STEAM is an educational approach to learning that articulates Science, Technology, Engineering, Arts and Mathematics as access points for guiding students' enquiry, dialogue and critical thinking. The approach aims to strengthen the foundation of STEM to promote the students in enhancing their critical thinking skill and recognize the integration of Arts, Science, Technology, Engineering and Mathematics. Integrating Arts activities can decidedly enliven the curriculum content, make learning outcomes more successful and interesting to both teachers and students and introduce powerfully, inspired, creative and logical thinking into the teaching-learning process. Integrated STE(A)M teaching reflects the effort to combine some or all four disciplines of Science, Technology, Engineering, and Mathematics with at least one non-science subject (i.e., literature, history, economics, language classes etc.) into one learning unit or lesson. It is a storage space where people can place their digital resources such as software, applications and files. So, in simplified terms, we can say that the cloud is virtual storage space on the internet. A lot of people do get the cloud mixed up with the internet. However, the cloud is only one part of the internet and not the whole thing.

Integrating STEAM subjects will allow students to contextualize the knowledge acquired in each subject, and connect it with real-world challenges or STEAM professions. For example, if we want to introduce students to the importance of sustainability, we will need to examine this theme from various angles.

Consequently, in the Technology subject students will learn how to seek relevant information, in their Mathematics class they will be introduced in ways to gather and present data and in their Biology or Economics class they will have the time to reflect and learn about the ecosystem or design projects about sustainability respectively. This is the first step to ensure that students even as early on as in Primary school will be able to understand how this knowledge can help tackle or solve everyday problems. By integrating more than one STEAM subjects we encourage the use of pedagogical methods such as Project-Based Learning and prompt students to work collaboratively. The use of hands-on activities and the respective resources are required, but most importantly, teachers need to make good use of the resources they have among them and work with their colleagues.

The collaboration between teachers and students in different STEAM disciplines is already reported as a positive factor to self-efficacy. Integrating engineering and science provides opportunities for improving student learning and interest, especially when they are exposed not just to science content but also scientific enquiry. In fact, scientific inquiry and design-based thinking underlie decision-making processes across Science, Technology, Engineering, and Mathematics.

The purpose of this study is to investigate the importance of Google earth tools using the STEAM approach in project-based learning to make various projects. The main objective was to introduce the practical use of Google earth tools for making various projects regarding various subjects of the school curriculum. We investigated two possible mechanisms to explain the (1) the traditional process of project making and (2) innovative process of the project made using Google earth tools using the STEAM approach. Inquiry-based science education is crucial in STEAM teaching because students work on actual solutions to problems or questions by conducting research. They

question every principle they have been taught and test it in activities that take place in class or a lab. This way, they can validate or reject the theory they were introduced to, rejecting passive knowledge and endorsing the tangible application of knowledge.

1.1 Background

Google earth is a cloud-based technology. Google Earth Voyager and creation tools are a program to create presentations, field trips. Users can explore the globe by entering addresses and coordinates, or by using a keyboard or mouse. The program can also be downloaded on a smart phone or tablet, using a touch screen or stylus to navigate. It constructs pictures of the surface of our planet by downloading satellite data from a remote server using cloud technologies. The new creation tools in Google Earth allow you to easily create and share maps and stories about our world as an Earth project. You can create a project on any subject of your choosing, drawing place-marks, lines and shapes, adding rich contextual information to your places (text, links, images, videos, 3D views and Street View), and organizing your project into a narrative flow. You can share your project and collaborate with others. In presentation mode, viewers will fly from one place to the next following the narrative of your project, immersing them in the journey through Google Earth's imagery and the custom content you provide. Google Earth enables everyone to explore the world through rich, educational experiences in Voyager. Voyager is a curreted collection of guided tours, geography quizzes, and rich data visualizations by some of the world's leading storytellers, scientists, and nonprofits. This is apt for teachers because no programming skills are needed! The location and size of the region in the picture is fully under the control of the user. View Earth as a globe, spin it with a drag of the mouse, and marvel at its large-scale physiographic features such as your house, mountains, rivers, streets, oceanic trenches and transform faults. Calculate area by drawing lines by joining places. To explore in more detail, one can zoom in to reveal rivers, lakes, cities and roads. Inevitably, the resolution imposes a limit to the zoom facility; resolution varies from one region to another and is higher in some urban areas. Google Earth provides a series of other tools through the desktop application. Additional globes for the Moon and Mars are available, as well as a tool for viewing the night sky. A flight

simulator game is also included. Other features allow users to view photos from various places uploaded to Panoramio, information provided by Wikipedia on some locations, and Street View imagery. The web-based version of Google Earth also includes Voyager, a feature that periodically adds in-program tours, often presented by scientists and documentarians. The program allows interesting locations to be remembered as placemarks, which does away with the need to record the location's latitude and longitude for its later retrieval. Google Earth comes with some placemarks of city views and some spectacular scenery. After you're done building your interactive tour, it can be shared with anyone via a link.

There are apprehensions that these Google tools only can be applied to Geography subjects but it can be used for any subject and for all lessons which you teach and to all the subjects. My students' attention span also increased because of these Google tools. As the researchers started exploring the tools right from My Maps, Google Earth, Voyager stories, Time-lapse, Google expedition, Google earth pro etc. Teachers could visualize in their mind different topics and ways to use these tools in their online lesson teaching. Some of the topics on which they have created Integrated STEAM approach cloud presentations are

1. Art Integrated project on Temples of Orissa and Maharashtra.
 - a) Study of temples through drawing.
 - b) Study of shade and light.
 - c) Study the structure of temples of Odisha: e.g. Sun Temple Konark, Jagannath Puri Temple
 - d) Geometrical Shapes /Patterns found in these temples.
 - e) Area of the overall temple.
 - f) Height, Area, distance or any other measurements related to different structures situated inside the temple.
 - g) Study of any specific architecture related to temples.
 - h) Greening the temple landscape.
 - i) Improving energy efficiency.
 - j) Protection of wildlife & wild places.
 - k) Waste management
 - l) Faith & Food

2. Crop Production- Creating a Map story showing different soils found in different states, History, geographical regions of India, area and different types of crops grown over there.
3. Art Integrated project on a story on Modern methods of irrigation- drip and sprinkler irrigation, places where this practice is done integrating all subjects.
4. Create a story on Storage of grains in granaries, jute bags, Silos. Where are Silos placed in our country integrating History, Maths, Arts?
5. Story of Discovery of Microscope involving all the major Microbiologists using the Integrated STEAM approach.
6. Art Integrated STEAM approach to design a story on major epidemics.
7. Story on commercial use of Microorganisms- Major wineries of the world using STEAM.
8. Integrated STEAM project on Vaccine development all around the world. Etc.
9. This integrated STEAM learning scenario on graphene, a material with excellent physical and chemical properties. The chosen subjects for this learning scenario were Physics, Chemistry, Art, Informatics and English Language. With this learning scenario, we had the opportunity to introduce your students to the material of graphene and provide a well-rounded understanding of its qualities in the subjects of Physics and Chemistry. In the subject of Informatics, students will have the chance to apply their knowledge plus principles from Mathematics Arts to design and 3D print graphene, while in the subject of English they will exercise their conversational and translation skills.

In this present paper, the importance of Google earth tools using STEAM approach maps are cited. But this paper describes the introduction of Google earth tools using the STEAM approach. It also lays out the importance of tools in project-based learning and it measures the typical use by teachers and students.

The following questions guided the research: what is the students and teachers perception of the Google Earth tools experience Integrated STEAM approach?

What are the implications on students and teachers motivation in Google earth tools using the STEAM approach in project-based learning projects? Does significant improvement in project making proficiency among novice-level learners exist and can it be measured?

2. LITERATURE REVIEW

2.1 From STEM to STEAM: toward a human-centered education, creativity & learning thinking

To challenge the common pedagogies found in STEM (Science, Technology, Engineering and Mathematics) education with a particular focus on engineering. The dominant engineering pedagogy remains "chalk and talk"; despite research evidence that demonstrates its ineffectiveness. Such pedagogical approaches do not embrace the possibilities provided by more student-centric approaches and more active learning. The paper argues that there is potential confusion in engineering education around the role of active learning approaches and that the adoption of these approaches may be limited as a result of this confusion, combined with a degree of disciplinary egocentrism. The paper presents examples of design, engineering and technology projects that demonstrate the effectiveness of adopting pedagogies and delivery methods more usually attributed to the liberal arts such as studio-based learning. The paper concludes with some suggestions about how best to create a fertile environment from which inquiry-based learning can emerge as well as a reflection on whether the only real limitation on cultivating such approaches is the disciplinary egocentrism of traditional engineering educators. (Connor, A., Karmakar, S. & Whittington, C.)

Leveraging Google Geo Tools for Interactive STEM Education: Insights from the GEODE Project

Web-based imagery and geospatial tools have transformed our ability to immerse students in global virtual environments. Google's suite of geospatial tools, such as Google Earth (\pm Engine), Google Maps, and Street View, allow developers and instructors to create interactive and immersive environments, where students can investigate and resolve common misconceptions in STEM concepts and natural processes. The GEODE (.net) project is developing

digital resources to enhance STEM education. These include virtual field experiences (Vess), such as an interactive visualization of the breakup of the Pangaea supercontinent, a "Grand Tour of the Terrestrial Planets," and Giga Pan-based VFEs of sites like the Canadian Rockies. Web-based challenges, such as Earth Quiz (.net) and the "Fold Analysis Challenge," incorporate scaffolded investigations of geo-science concepts. Earth-Quiz features web-hosted imagery, such as Street View, Photo Spheres, Giga Pans, and Satellite View, as the basis for guided inquiry.

[STEM+A = STEAM]

With an increasing interest in STEAM education, several studies have examined teachers' perceptions and their practices of STEAM education (e.g., Han & Lee, 2012; Lee, Park, & Kim, 2013; Lim & Oh, 2015; Lim, Kim, & Lee, 2014; Noh & Paik, 2014; Shin, 2013; Shin & Han, 2011). These prior studies suggest that the majority of teachers think that STEAM education is needed (Han & Lee, 2012; Lim & Oh, 2015; Shin & Han, 2011) and that STEAM education would have a positive impact on students' motivation and learning (Lee, Park, & Kim, 2013; Lim & Oh, 2015; Shin & Han, 2011). However, some research found a significant gap between teachers' perceptions and actual practices of STEAM education. For example, using survey data for 987 elementary and secondary school teachers in a metropolitan region, Shin (2013) found that although the majority of Korean teachers (about 65%) agreed on the necessity of STEAM education, only about 18% actually implemented STEAM lessons in their class. Other studies investigated the challenges and difficulties teachers face to implement STEAM education. The research identified difficulties in finding time for preparing STEAM lessons, insufficient instructional materials, and a lack of teachers' expertise on STEAM education as major problems in implementing STEAM lessons (Han & Lee, 2012; Lee, Park, & Kim, 2013; Lim & Oh, 2015; Shin, 2013). A lack of understanding of the relation among STEAM content areas for content convergence and difficulty in cooperating with other teachers were also cited as challenges in implementing STEAM lessons (Lee, Park, & Kim, 2013; Noh & Paik, 2014).

Opportunities and challenges of teaching STEAM careers

In secondary education and as students prepare themselves to take important decisions on their future, teachers need to be able to provide them with accurate and up to date information on the existing STEAM careers paths and profiles. In many countries, information about STEAM careers is lacking, which means students are misinformed or do not know enough about STEAM careers. Teachers, on the other hand, may lack STEAM knowledge, confidence, and self-efficacy in teaching about STEAM careers. Self-efficacy refers to a teacher's belief in his/her ability to successfully cope with tasks, obligations and challenges related to his/her professional role (e.g., didactical tasks, managing discipline problems in the class, etc.) (Caprara et al., 2006). Lack of STEAM knowledge can make it difficult for teachers to introduce STEAM careers to their practice and tailor activities to the age of students.

Students in secondary education have already started forming their own ideas and preferences on what they want to study in the future. Depending on their previous educational but also life experiences they might also have their own bias regarding STEAM and STEAM careers. They might worry about their grades and performance in STEAM subjects or they might think that STEAM careers are only for people interested in research and/or engineering. For this reason, it is important to trigger students interest in STEAM by providing them with access to a variety of exciting STEAM careers information and role models that connect to reality, are approachable, respond to real-life problems and can inspire their interest in STEAM. Offering possibilities for them to exchange with STEAM role models from various paths and backgrounds and providing them with answers to their questions and insecurities can definitely make a difference.

2.2 Context

To inspire students, see the added value of STEAM subjects and careers, contributing the same way in tackling unfavorable perceptions and the overall lack of interest in Science, there is a need to reconsider the way STEAM subjects are taught. For this purpose, there is a need for an integrated way of teaching. More specifically, there is a need to combine Science classes

with other disciplines, ensuring that the integrated STEAM education will contextualize STEAM teaching in such a way that it becomes more attractive for every student. Right now, there is no integrated STEAM education framework in India that will further enhance coherence in STEAM education. It is essential to bring together partners from different countries, already working in STEAM education, policy, pedagogical innovation and professional development of teachers, educators and school leaders, and engage them in discussions, planning, implementing and the review of new practices. This will ensure that the topic is given new and more intense attention within each country. Therefore, the STEAM IT project will lead the way in the creation and testing of the 1st Integrated STEAM framework, aiming to strengthen the coherence in STEAM education by defining collectively with MoEs and STEAM teachers the integrated STEAM education framework. The focus group teachers that will create interdisciplinary and innovative teaching and learning scenarios, will be used to test the proposed framework of reference for integrated STEAM education.

The creation and implementation of the aforementioned framework are particularly important for students who do not link STEAM subjects and their use with their everyday life, but most importantly with their future career paths. The teaching of each STEAM subject individually often prevents students from linking those subjects, consequently missing out on a cohesive educational opportunity that might largely affect their study path choice and eventually a career.

It is additionally important for teachers of Primary and Secondary schools to work together and fully exploit the benefits of the in-between collaboration, while contributing to the creation of innovative and cross-disciplinary approaches to STEAM teaching in education, each adding their own insight, expertise and knowledge. This collaboration and continuous feedback aim to provide an opportunity for reflection and support a steady and much necessary change in formal education but also career consultancy. This way, schools will assume the additional role of mentorship supporting their students collectively.

An Integrated STEAM project-based classroom allows students to investigate questions, propose

hypotheses and explanations, discuss their ideas, challenge the ideas of others, and try out new ideas. Research has demonstrated that students in Integrated STEAM project-based learning classrooms get higher scores than students in traditional classrooms (Marx et al., 2004; Rivet & Krajcik, 2004; William & Linn, 2003).

Technology tools can help transform the classroom into an environment in which learners actively construct knowledge (Linn, 1997; Tinker, 1997; White & Fredrickson, 2000). Edelson (2001) gives three reasons to use technology tools in schools: (1) they align with the practice of science, (2) they can present information in dynamic and interactive formats, and (3) they provide unprecedented opportunities to move to teach away from a transmission-and-acquisition model of instruction.

The Google Earth tool project analyzed in his article aimed to follow the project-based learning model thus, students engaged to practice for making various projects of different curriculum subjects and deal with the STEAM project making matter to compare similarities and differences between their projects using google earth tools and other students' projects using manual tools.

3. METHODOLOGY

3.1 Policy and initiative:

Under the Guidance of Hon'ble Nandkumar, (Then) Principal Secretary, Ministry of Education, Government of Maharashtra, 'PragatShaikshanik Maharashtra' (Educationally developed Maharashtra) program was undertaken by the Government of Maharashtra to impart quality education to all students in the state (Maharashtra State Government Resolution Dated 22nd June 2015).

3.2 Training Phase

Earlier when researchers used to give a topic to students for presentations, they used to manually prepare PPT in groups. They used to divide the work and prepare their part and there was no collaboration in preparing a ppt. It was just the compiling of the Ppt that was done. The individual engagement was limited. For Ppt, they used to download pictures from Google and then use it in Ppt using computers memory. So to find a better way of making presentations for online classes, researchers had taken a workshop on how to use

Google earth tools using the Integrated STEAM approach for making presentations. To evaluate the effectiveness of Google Earth in the classroom, researchers had conducted a small case study. Normally a group project presentation task is accomplished using PowerPoint delivered classes as a standard. 200 students of std VIII and 34 teachers were divided into two groups, 117 teachers and students were assigned in each group. Two independent sets of students received instruction exclusively on Zoom, Google meet and Microsoft Teams using one of the two methods, PowerPoint or Google Earth using the STEAM approach, throughout classes. In two different sections of students, researchers delivered the class during one section in PowerPoint while the other section received the class on Google Earth using STEAM approach representation. The same ideas were displayed so that the objective of the class is not missed. To assess the retention of the material, during the class following the lecture, researchers developed short non-graded quizzes of 10 questions. The feedback from participants helped researchers to evaluate if the students and teachers being taught using Google Earth Integrated using STEAM approach were gaining as much, less or more comprehension than those being taught by PowerPoint. Students and teachers were then evaluated during the next class through a series of questions on their ability to recall the material of the previous lesson. Students and teachers of both groups were told to present their topic in class. One group made a presentation using a traditional tool and another group gave a presentation using Google earth creation tools using the Integrated STEAM approach. It was evaluated that the group that used Google earth creation tool for the presentation was more effective than the traditional one. Studies have demonstrated that the use of Google Earth has helped to improve students and teachers comprehension of major concepts and skills while also helping students and teachers gain confidence in their knowledge. It supported spatial thinking but also helped to develop critical analytical skills and prepared students to use more advanced features.

3.3 Participants

Total 200 students from STD VIII were selected i.e., 160 students from Vikhe Patil Memorial School, 15 students from NMC School no. 18 Anandwali, Nashik,

District. Nashik (M.S), India, 10 students from Bombay Scottish school, Pawai, India and 15 students from Secondary School MihailSadoveanuHusi, Romania and 34 Zilha Parishad teachers from Nashik Maharashtra were selected for the above-said project. All participants were given training on the Google Earth creation tools using the STEAM approach on Zoom platform, Google meets and Microsoft Teams for 6 hours in total. All the students and teachers were very eager to learn the innovative project method of Google earth tools using the STEAM approach and how it was different from the traditional project learning method.

3.4 Instruments

Zoom cloud meeting, Google meet and Microsoft Teams online platform were important instruments to implement this research. It was very effective and easy to use because researchers could record their training sessions, responses and feedback from participants during sessions. There were a lot of options before researchers chose the right instruments.

3.5 Methodology

Mix method was used for the present research. There was a descriptive survey method and an experimental method was used. Researchers took a survey. In this survey, the questions were asked about the perceptions; satisfaction level and understanding about Google earth tools using the Integrated STEAM approach of students and teachers were evaluated. Like any other online platform for lecture delivery, it took time to master certain features and applications. For example, many teachers are very versed in PowerPoint, but when a new version gets released, it takes some time to learn the new features making presentation creation slower. The challenge for the teacher using Google Earth using the Integrated STEAM approach is to find examples in the world that relate the material from the reading assignment to the student and make it flow in class. Although Google Earth using the STEAM approach presents the teacher some challenges, there are definite advantages. Google Earth's greatest advantage lies in its dynamic nature. The presentation moves from place to place, scale to scale, map to remotely sensed images to pictures. Students and teachers were engaged because they didn't know where

they were going next. The teacher also incorporated things that were relative to the students. The teacher can fly to areas near hometowns, campus, or in the State, the school was located. This attempt drew in the students and increased their interest. Google Earth using the STEAM approach received very positive remarks from teachers and students. When asked to write a reflection on the classes using the platform, most of the students liked receiving the class through this delivery system. More than one student wrote that they "liked the change of pace." Others enjoyed the interactive nature, especially when they made suggestions and I navigated to those locations. Positives also included the pictures that were embedded; the 3D nature of the terrain, the time-lapse function in Google Earth and many enjoyed seeing the maps overlaid on the virtual globe.

One of our researchers, Ms. KundaBachhav used her laptop for student's sake. Her laptop has been used by her students for their google earth tools project making. Lots of learning and engagement had been done completing this project.

Here are some of the links of the presentation made by the students and teachers

1. https://earth.google.com/earth/rpc/cc/drive?state=%7B%22ids%22%3A%5B%221x4sv1HEj4LptsiviUyLuHg_4ntUxgcJl%22%5D%2C%22action%22%3A%22open%22%2C%22userId%22%3A%22105948299241687428694%22%7D&usp=sharing
2. <https://earth.google.com/web/@0,0,0a,22251752.77375655d,35y,0h,0t,0r>
3. <https://earth.google.com/web/@0.07229685,113.11258207,18179.08250108a,63151824.88895416d,35y,359.97866233h,0t,0r/data=MicKJQojCiExT3YzdVc5T0pRc3JtQk1VZE1vbk5FbXlXM0pIY2hwdy06AwoBMA?authuser=0>
4. https://earth.google.com/earth/rpc/cc/drive?state=%7B%22ids%22%3A%5B%221kYtYECttCWJzqzBy_VKgNtcpsG2pq0IA%22%5D%2C%22action%22%3A%22open%22%2C%22userId%22%3A%2210869244139457%22%7D&usp=sharing
5. https://earth.google.com/earth/rpc/cc/drive?state=%7B%22ids%22%3A%5B%221AaVcXKr2kDVGb8-p0-eZq_fZiYsZcntA%22%5D%2C%22action%22%3A%22open%22%2C%22userId%22%3A%22110397488711324037527%22%2C%22resourceKeys%22%3A%7B%7D%7D&usp=sharing
6. https://earth.google.com/earth/rpc/cc/drive?state=%7B%22ids%22%3A%5B%221QwtY14zLysZ0ww_Z3NNI2ywtOLrlQg2o%22%5D%2C%22action%22%3A%22open%22%2C%22userId%22%3A%22100636431388536769065%22%2C%22resourceKeys%22%3A%7B%7D%7D&usp=sharing
7. <https://earth.google.com/earth/rpc/cc/drive?state=%7B%22ids%22%3A%5B%221pDKm0aqcLZersTvpV8-WyAh6OJ4YrjOz%22%5D%2C%22action%22%3A%22open%22%2C%22userId%22%3A%22100636431388536769065%22%2C%22resourceKeys%22%3A%7B%7D%7D&usp=sharing>

3.6 Advantages

Advantages of Google Earth tool using STEAM approach shared in feedback by the Zilla Parishad teachers from Nashik district and students from Nashik, Pune and Mumbai district.

1. It is an excellent tool to promote the STEAM approach in school education to improve students' innovative ability.
2. It leverages life skills.
3. It is appropriate for educational use in a wide range of subject areas.
4. It is an effective tool for integrating the study of multiple disciplines.
5. It is a great research tool.
6. The collaboration between teachers in different STEAM disciplines is already reported as a positive factor to self-efficacy. Integrating engineering and science provides opportunities for improving student learning and interest.
7. It is pre-loaded with a wide variety of useful data.
8. It encourages creative, critical thinking, problem-solving skills and values through STEAM education.
9. It can be launched easily to explore an issue that arises during an informal discussion.
10. It can work with abundant third-party data that

is available on the web.

11. It provides an integrated approach to teaching and learning and developing connections between curriculum learning objectives, lesson design and its implementation.

4. RESULTS AND DISCUSSIONS

4.1 Survey

The team of researchers conducted training for students and teachers. This training was conducted for 6 hours a week. Teachers and students used to repeat the steps simultaneously along with the researcher. A pre-survey was conducted to find out their knowledge and perception of Google Earth Tools using the STEAM approach. It was found that students and teachers were unaware of free Google Earth Tools and STEAM approaches in lesson planning. Once the training was imparted, students and teachers gained mastery over it and started preparing plans and projects on various topics using the STEAM Integrated approach. A post-survey was done after training and it was found that teachers have gained mastery over the usage of those tools. Many teachers were very versed in PowerPoint, but when a new version got released, it took some time to learn the new features making presentation creation slower. The challenge for the teacher using Google Earth using the STEAM approach is to find examples in the world that relate the material from the reading assignment to the student and make it flow in the class. For the qualitative and quantitative type of analysis, students and teachers were asked to respond to the survey questionnaire. Surveys were administered during the last week of the project.

The surveys' answers (figure 1) depict a high percentage of satisfaction among teachers and students regarding the perception of the validity of the Google Earth tools using STEAM approach experience. Students and teachers were able to use Google earth tools handily and evaluate their friend positively. The higher satisfaction rate expressed by the students and teachers could be attributed to their higher proficiency level in using Microsoft teams' app, Zoom and Google meet, these students may have been better equipped technically thus more confident about interpersonal communication. It is worth considering these

circumstances when designing future innovative projects.

Students as well as teachers were also asked to respond to two open-ended questions as well as an optional comment that solicited general feedback. The researchers coded responses to reveal patterns in students' perception of the relevance and interest of innovative learning in Google Earth Tools classes using STEAM approach experience as well as challenges encountered during the experience. Comments were thematically organized in 4 categories as shown in Figure 2.

From both participants' perspective, the Google earth tool using the STEAM approach experience was notably relevant and positive. Students and teachers developed a sense of self-accomplishment and appreciated the "real-life" project learning setting that allowed them to manage deep, meaningful, sustained conversations with local, national, and international locations which they would not likely have seen otherwise because of the lack of an innovative program on the school campus. The program also ultimately promoted friendship and collaboration between students and teachers that persisted after the course.

As the following quotes from students and teachers illustrate, participants were open and interested to know about others' personal experiences and different ways of life and were anxious to participate in the weekly sessions, enriching the discussion with personal topics beyond the assigned tasks.

4.2 Feedback from the Participants'

One of the government teachers pointed out the advantage that Google earth presentations are environment friendly and paperless.

"Introduction of Google Earth by Mrs. Nidhi Jain Mam was really a great chance to learn Project-Based Education using Google earth tool and Integrated STEAM approach for teachers and students as well. I think it is the best way to present multiple ideas in a single project work using Google Earth. One can present any topic with its all aspects, such as its images, location, and distance and how to reach the same location through a link. I think it's the type of environment-saving project preparation. It is a totally paperless project work. Thanks a lot, Resp. Nidhi Jain

Mam for sharing this innovative idea and your open-hearted guidance." by Mr. Girish V. Darunte, V. N. NAIK HIGH SCHOOL, MANMAD (Nashik)

Mr. Prakash was able to execute all the steps and made a superb presentation on the Dams of India. "On 1 November 2020, with guidance from Hon. Yogesh Sonavane Sir a workshop was taken online teaching about Google Earth using the STEAM approach. In this workshop, attendees were taught about using Google Earth for teaching by Nidhi Jain through presentations. In this workshop, 30-40 teachers from Nashik created different projects showing places of importance. I also created a Nashik dam project during the workshop. Due to online workshops arranged by Nidhi Jain ma'am, Sonavane Sir, DIET Nashik, knowledge of teachers is improving." by -Prakash Chavan Z.P. Teacher Nashik

My project on Nashik Dams

<https://earth.google.com/earth/rpc/cc/drive?state=%7B%22ids%22:%5B%221sOLAiq9NE4YoTHSDFVU9umztYLhwOMYW%22%5D,%22action%22:%22open%22,%22userId%22:%22103490392935842741052%22,%22resourceKeys%22:%7B%7D%7D>

Another teacher said that he was able to develop integrated projects using Google Earth.

"The webinar was taken by Hon. Yogesh Sonwane sir and Nidhi Jain madam on Google tools using the STEAM approach was very informative and useful. They explained very simply, how to use Google tools to give learning experiences of Science, History and Geography. Every detailed information about all features is provided by them. I tried these tools for making a project on Bird sanctuary in Nashik. I am very thankful to Sonwanesaheb & Nidhi madam for giving me a treasure of Google tools using the STEAM approach" by **VARSHA PARAG CHAUDHARI, GRADUATE TEACHER, Z. P. PRIMARY SCHOOL KHAMBALE TAL. IGATPURI DIST Nashik**

Ms. Nidhi Jain conducted a session with Bombay Scottish School, Powai, students of grade 8 and 9, who had never made any project using Google Earth tools earlier. It not only exposed the students to new technology but also offered meaningful collaborative

opportunities for them. All the students had hands-on experience. Ms Nisha Sanga, their science teacher, believed that students could give an artistic touch to their technical projects.

Students Bytes:

A student of STD VIII shared that using placemark feature he could go to places virtually where going physically was not possible.

"Google Earth using the STEAM approach is a nice application in which we can have a virtual tour around the world and we can get a lot of information about different places and monuments. We can virtually visit places where we can't physically reach Delhi during this Covid19 pandemic" **Advaith Pillai, STD VIII, Vikhe Patil Memorial School, Pune.**

"I felt that making projects on Google Earth using the STEAM approach looks more professional and complete." by **Arya Raghuvanshi, STD VIII, Vikhe Patil Memorial School, Pune.**

"It helped their group members to get excellent grades in Art Integrated projects." by **Diva Malhotra of Std IX, Vikhe Patil Memorial School, Pune.**

"With the STEAM approach, we actually collaborated and took the risk of exploring places without actually going there. It is the best possible way during Covid-19 situation and otherwise too." **Mihika Nair, STD IX, Bombay Scottish School, Powai, Mumbai.**

4.3 EVALUATION

After training students and teachers were evaluated by a Google form quiz and the google drive link of the presentations made by them on various subject topics using Google Earth using the STEAM approach received very positive remarks from a group of students who used Google Earth to make presentations. When asked to write a reflection on the classes using the platform, most of the students liked receiving the class through this delivery system. More than one student wrote that they "liked the change of pace." Others enjoyed the interactive nature, especially when they made suggestions and I navigated to those

locations. Positives also included the pictures that were embedded, the 3D nature of the terrain, and the time-lapse function in Google Earth using the STEAM approach and many enjoyed seeing the maps overlaid on the virtual globe. There were some negative remarks from a few students. Some did not like the time it took to get from one place to another, some prefer PowerPoint because that is what they are used to, and some said they got more comfortable with the class as the classes progressed.

4.4 LIMITATIONS

The main limitation of Google Earth tools is that it requires training from experts and requires a computer with internet to make presentations. Also, students of urban school Vikhe Patil Memorial School used laptops and Desktops while students of village Nashik District used mobile to make presentations which restricted the view. Google Earth gives the teacher the ability to alter the course at any time. If a student asks a question about a location not built into the presentation, the teacher can easily go there if it will contribute to the discussion. The student then becomes an interactive part of the lecture. Giving control of the lecture to students is scary for some teachers. Teachers must be confident and competent enough to be able to deviate off a predetermined path and integrate information and locations at the moment. This takes more preparation because a complete understanding of the material is a necessity. The manipulation of Google Earth during a lecture can present some possible issues. In our country, information about STEAM careers is lacking, which means students are misinformed or do not know enough about STEAM careers. Teachers, on the other hand, may lack STEAM knowledge, confidence, and self-efficacy in teaching about STEAM careers. Self-efficacy refers to a teacher's belief in his/her ability to successfully cope with tasks, obligations and challenges related to his/her professional role (e.g., didactical tasks, managing discipline problems in the class, etc.

Google Earth using the STEAM approach requires the teacher to be near the computer, thus limiting those who like to walk around while lecturing. At this time there is no way to advance to the next location from a distance via a clicker device. Because of

the interactive nature, it is hard to have someone else control the platform. The teacher must get into the classroom before class and run through the locations before delivering the lecture. This preloads the placemarks and stores the images in temporary files that come up quick and clear. If the teacher runs through the locations without doing this they run the risk of a slow lecture with many delays.

5. CONCLUSIONS

Google earth tool using the STEAM approach had a key-place in the classroom. Delivering a class exclusively with Google Earth using the STEAM approach was effective at presenting the material that covered the objectives of the class. It made us understand the current situation of STEAM education in our classrooms and the need for an integrated approach; explored pedagogical approaches related to integrate STEAM. Participants got to know the STEAM IT learning scenario. It also developed a capacity building program for Primary and Secondary school STEAM teachers and students, based on this framework, with a particular focus on the contextualization of STEAM teaching, especially through Google Earth Tools in education in project-based learning. STEAM education brought reality into the classrooms and led to a mental shift expanding the current curriculum to inculcate STEAM. It helped students connect to careers based on STEAM. Teachers observed a paradigm shift in different ways of doing the same thing. Also, it helped to develop motor sensor brain alignment process development among students. Students were able to design relevant questions and used Google earth tool project-based learning and learnt problem-solving skills. It was also found that pre-service or in-service training is a must for teachers to design and integrate STEAM using Google tools in their lesson plan.

6. INFERENCES

- (1) If the system is willing to make changes, it can do so even without any extra financial investment.
- (2) Administration needs to find best practices, promote them and make them universal in the system.
- (3) Motivation and appreciation are great tools to promote best practices.

(4) Using Google Earth tools using the STEAM approach is a great concern, but if the system starts tracking innovative project making movements, we can achieve the target of 100% quality enhancing.

(5) The Google Earth tool project Movement has global implications. It can prove useful in any context where there is the issue of the traditional way of project making.

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Tables and Figures

Figure 1- Participants rating of the Google Earth Tools project under the STEAM approach

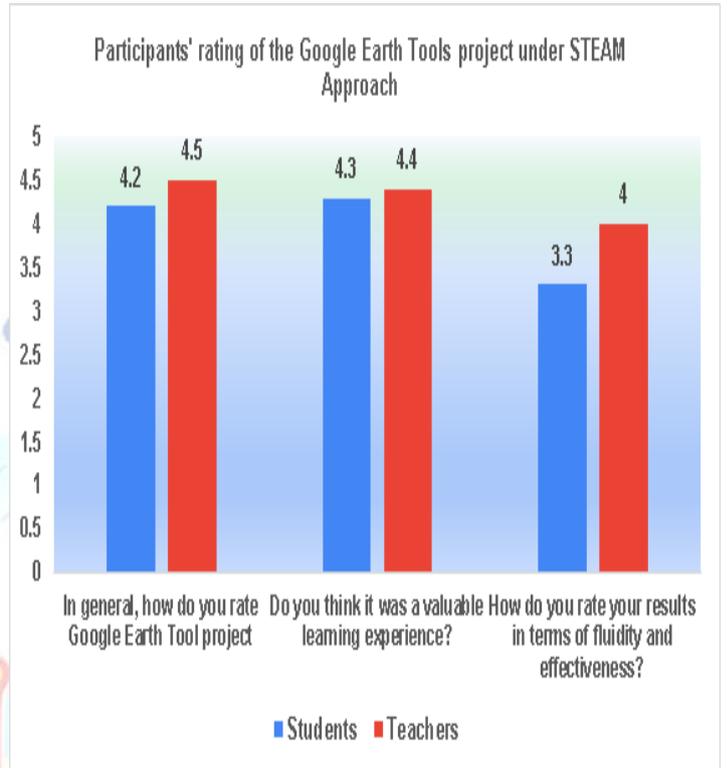


Figure 2- Participants' perception of the Google Earth Tools project under the STEAM approach

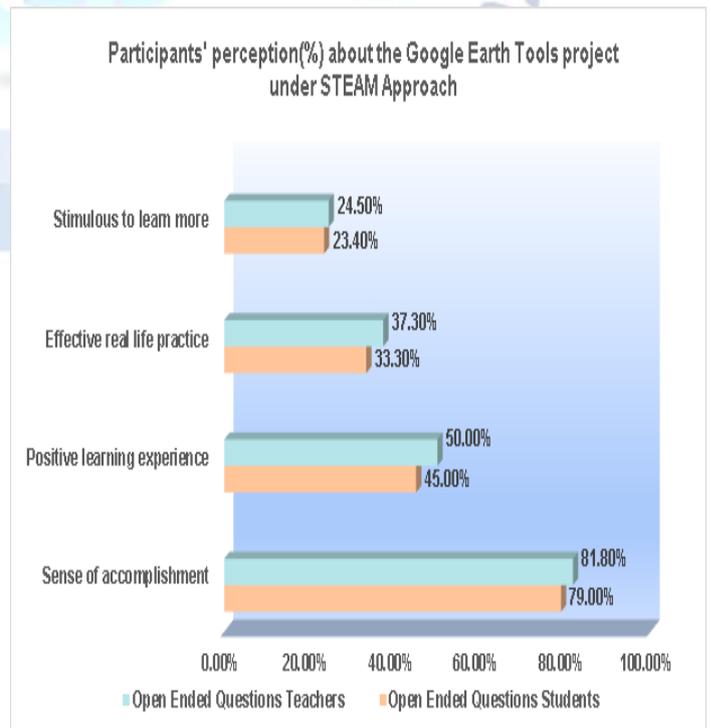


Figure 3- Participants' Competences about the Google Earth Tools project under the STEAM approach

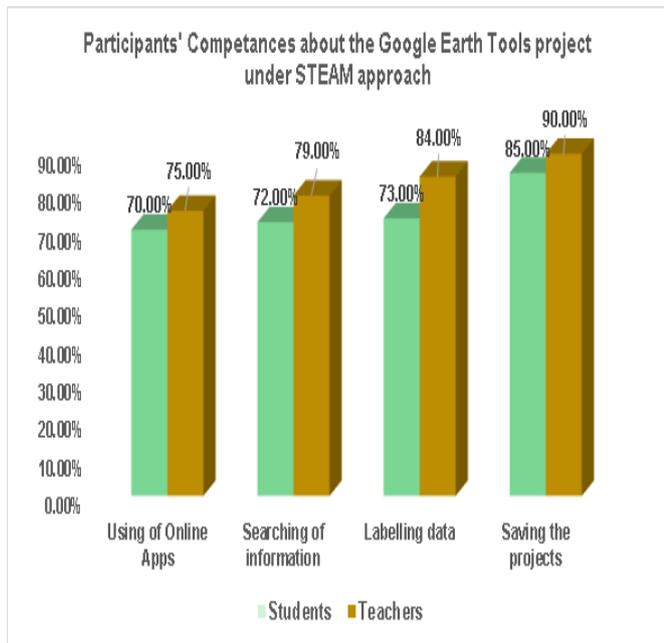
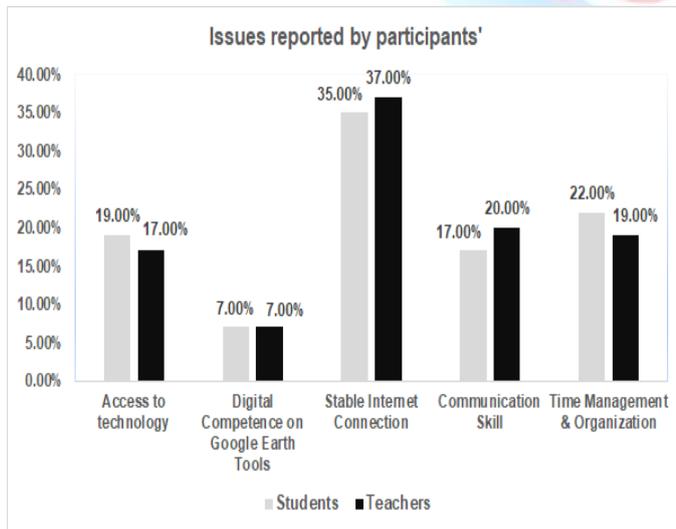


Figure 4- Issues reported by Participants about the Google Earth Tools project under the STEAM approach



10. Experiences reported by Participants

Appendix A: Teachers' as well as Students' Comments and responses to our open-ended questions and the most valuable tools to evaluate the validity of these learning experiences.

Sr. No.	Name of Participant	Designation	Comment
1	Corina Sudea, Secondary School Mihail Sadoveanu, Husi, Romania	Teacher	"The value of STEAM education highlighted the importance of fostering 21st Century skills such as Collaboration, Communication, Creativity and Critical Thinking. My students used this approach to solve their problems with innovative way. The students are digital natives. They tend to know way more about changing technology than we do, and we need to do what we can do to take advantage of above skills in the classroom"
2	Smt. Kunda J. Bachhav, Assistant Teacher, NMC School no. 18, Anandwadi, Nashik	Teacher	"STEAM was really an innovative approach for my students of grade 8th. It helped to inculcate the major 4 'C' mentioned in the 21st century skills. That's why I request all my teacher friend that instead of one-way teaching, let the students to learn using STEAM approach in their classes."
3	Smt. Nisha Sanqa, Bombay Scottish School, Powai, Mumbai	Teacher	"Ms. Nidhi Jain conducted a session with Bombay Scottish School, Powai, students of grade 8 and 9, who had never made any project using Google Earth tools earlier. It not only exposed the students to new technology but also offered meaningful collaborative opportunities for them. All the students had hands-on experience. Myself was of the opinion that students could give an artistic touch to their technical projects."
4	Smt. Varsha Parag Choudhari, Graduate Teacher, Z.P. Primary School Khambale, Tal. Igalpuri, Dist. Nashik	Teacher	"Introduction of Google Earth by Mrs. Nidhi Jain Mam was really a great chance to learn the Project Based Education for teachers and students as well. I think it is the best way to present multiple ideas in a single project work using Google Earth. One can present any topic with its all aspects, such as its images, location, distance and how to reach the same location through a link. I think it's the type of environment saving project preparation. It is totally paperless project work. Thanks lot Resp. Nidhi Jain Mam for sharing this innovative idea and your open hearted guidance."
5	Mr. Prakash Chavan, Assistant Teacher, Z.P. School Karanjavan, Tal. Dindori, District Nashik	Teacher	"On 1 November 2020, with guidance from Hon. Yogesh Sonavane Sir a workshop was taken online teaching about Google Earth. In this workshop attendees were taught about using Google Earth for teaching by Nidhi Jain through presentations. In this workshop 30-40 teachers from Nashik created different projects showing places of importance. I also created a Nashik dam project during the workshop. Due to online workshops arranged by Nidhi Jain ma'am, Sonavane Sir, DIET Nashik knowledge of teachers is improving."
6	Smt. Varsha Parag Choudhari, Graduate Teacher, Z.P. Primary School Khambale, Tal. Igalpuri, Dist. Nashik	Teacher	"The webinar taken by Hon. Yogesh Sonavane sir and Nidhi Jain madam on Google tools was very informative and useful. They explained very simply, how to use Google tools to give learning experiences of Science, History and Geography. Each and every detailed information about all features are provided by them. I tried these tools for making a project on Bird sanctuary in Nashik. I am very thankful to Sonavane Saheb & Nidhi madam for giving me a treasure of Google tools."
7	Advaith Pitai, Std VIII, Vikhe Patil Memorial School, Pune	Student	"Google Earth is a nice application in which we can have a virtual tour around the world and we can get a lot of information about different places and monuments. We can virtually visit places where we can't reach physically like Dalol during this Covid-19 pandemic"
8	Arya Raghuvanshi, Std VIII, Vikhe Patil Memorial School, Pune	Student	"I felt that making projects on Google Earth looks more professional and complete."
9	Divya Malhotra of Std IX, Vikhe Patil Memorial School, Pune	Student	"It helped their group members to get excellent grades in Art Integrated projects."