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MAIN TOPIC: BEHIND THE SCENES- MAKING STEAM WORK IN SCHOOLS SUB-TOPIC: INTEGRATION OF STEAM AS A CROSS CURRICULAR APPROACH

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कल्पयति येन वृत्तिं येन च लोके प्रशस्यते सद्भिः।

स गुणस्तेन च गुणिना रक्ष्यः संवर्धनीयश्च॥[1]

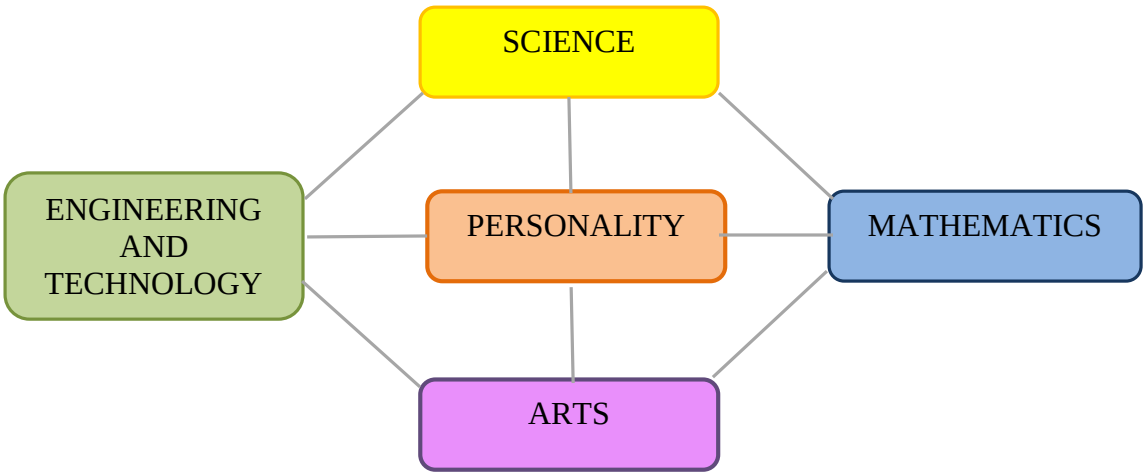
The skill that sustains livelihood and which is praised by all should be fostered and protected for your own development.

INTEGRATION OF STEAM

Making Education skill oriented by adding different subjects in a harmonious way. NEP 2020 is endeavoring to make students independent and skill enriched when they move out of the portals of their school system. Integration of different subjects have led the learning procedures a different dimension.
The Indian Education System has core modules that revolve around Science, Technology, Engineering, Art and Mathematics. Sound knowledge of/in these subjects would definitely develop a student as an independent and empowered individual. Integration of these subjects in the curriculum can assure a well-rounded development of the student.

IMPORTANCE OF STEAM

Let's first talk about the importance of each component of *STEAM*:
SCIENCE: The most life-oriented subject, where theory and practicality go hand in hand.
TECHNOLOGY: It makes a student's approach to problems both analytical and critical.
ENGINEERING: It gives a student an opportunity to design systems which can suffice the requisites of constructing another configuration under certain circumstances.
ARTS: The most sought-after subject by students, it hands a magical brush which gives students an opportunity to express them. Recently, CBSE has also stressed upon teaching a myriad of concepts by integrating various art forms along with different subjects.
MATHEMATICS: An extremely practical subject which develops an approach of being calculative in students.



A student's personality is groomed extensively in a school as he/she spends around 6 to 8 hours every day in the school. The interaction between students, their peers and teachers helps in shaping their personality. Participation in creative events by students helps in reinforcing their concepts and deepens knowledge.

Co-curricular approach in education leads to evolution of personality of students and is an integral part of their learning. Compartmenting the subjects exclusively will not result in the holistic development of students. With India venturing into diverse and modern technological advancements, it will be helpful if our curriculum is designed in collaboration with other subjects.

One methodology can integrate various subjects together, especially Science, Mathematics and Arts. Integration of Engineering and Technology will be generated once the students are comfortable with the orientation of the subjects. They can be guided appropriately by their mentors for amalgamation of all five basic components of STEAM.

One such effort was made by me in the Academic Session 2015-16 wherein I experimented with the liking of students of different sports. As is said by the great Napoleon Bonaparte, "There are only two forces that unite men-fear and interest", and I choose interest, to get the best out of my students. I motivated students to enhance their learning abilities. This was achieved by the dynamic use of learning topics and themes. This improved their skills and competencies which can be developed in a number of learning areas across the curriculum.

The salient details of the research work are as follows:

1. Name of the Project: The Nachiketa Project
2. No. of participants: 22
3. Forte of Participation: Choice of Sports
4. No. of Sports chosen: 9
5. Duration of Assessment: 10 months
6. Date of Commencement: April 1, 2016
7. Date of Conclusion: January 17, 2017

THE NACHIKETA PROJECT

A special Nachiketa Project Curriculum was designed for the participants. The Project Curriculum comprised of topics from Languages to History, Science and Mathematics, General Knowledge to Currents Affairs. Additionally, Mythology and Life Skills were also a part of their learning. Art integration also provided an extra edge to the students. The students were supposed to develop their own project files aesthetically. It often gives relief and a sense of excitement to the students and rejuvenates their mood which later on helps in increasing their focus on their studies.

PROCEDURE ADOPTED FOR THE NACHIKETA PROJECT

The Nachiketa Project commenced with a request letter sent to the parents to allow their wards to participate in this specially designed curriculum based on the choice of sports of their ward. A check list (added below) with details of the assignments to be submitted was provided to the students. It was a self-paced learning module. The participant was expected to complete it in the stipulated period. The assessment of the academic development of a participant was observed twice; once in the mid of the session and then at the end of the session. Performance in Term-1 and Term-2 Examinations of participants, with reference to the grades scored by them were tallied.

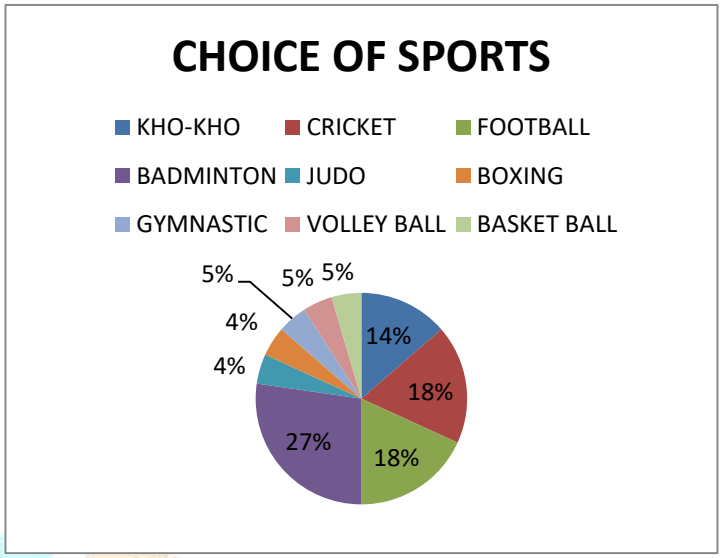
INTEGRATION THROUGH INTEREST
Let's explore the innate POTENTIAL of a child in his/her field of interest. i.e. SPORTS. A child may be asked e.g. in CRICKET, to draw a scene of a Cricket Match (ART & CRAFT), write the scientific concepts in alphabetical order (ENGLISH) and know about them (SCIENCE), collect information about various positions in the field and famous players' life and achievements (GK+HISTORY+READING SKILLS), know the measurements of the field and its conversions with some interesting statistics (MATHS). Most importantly a child may be asked to frame/narrate an incident highlighting the moral values associated with the sport (MORAL SCIENCE). A visit to an event of sports or to a stadium or to a match can also help a child to develop interpersonal skills (LIFE SKILL). In the whole it will be an activity where STUDENTS' TIME EMPLOYED PRODUCTIVELY (STEP) to excel learning integrating almost all the subjects.

THE CHECK BOX FOR PARTICIPATION

It was interesting to note that at the end of The Nachiketa Project there was improvement in the academic performance of 9 participants, 11 participants maintained their grades and 2 participants performed satisfactorily.

	Subject/Topic	Description	Checkbox
1.	Mythology	Story of Nachiketa	
2.	English	My favorite sport	
3.	Science	Scientific concepts involved in the sport	
4.	English	Reporting of any event pertaining to the favourite sport in newspapers	
5.	Life Skill	Visit to a stadium or a match or highlights of the event seen on the television	
6.	Art And Craft	Sketch of the favourite player or a scene of the game	
7.	Entertainment	Review of a movie show related to your favourite sport	
8.	Mathematics	Measurement of the field/arena	
		Conversion into different units	
		Calculation of area and perimeter	
9.	Data Handling	Interesting statistics of the game in the form of pie chart/bar graph/ line graph	
10.	General Knowledge.	Famous players of the favourite sport	
		General information about them with their pictures	
11.	History	Origin of The Sport-How Did It Came Into Present Form? Who Were The Pioneers?	
12.	Hindi	Write any story based on the sport (preferably of your own)	
13.	Value Education	What are the ethical requisites of the sport	
		Discipline of the players, interpersonal behaviour	
14.	Medical Science	Common injuries that occur in the sport and their remedies/preventive measures taken by the players	
15.	Funny Side Up	Narrate any incident that occurred with you when playing your favourite sport	
16.	Computer	Students are required to prepare a power point presentation for their Project	

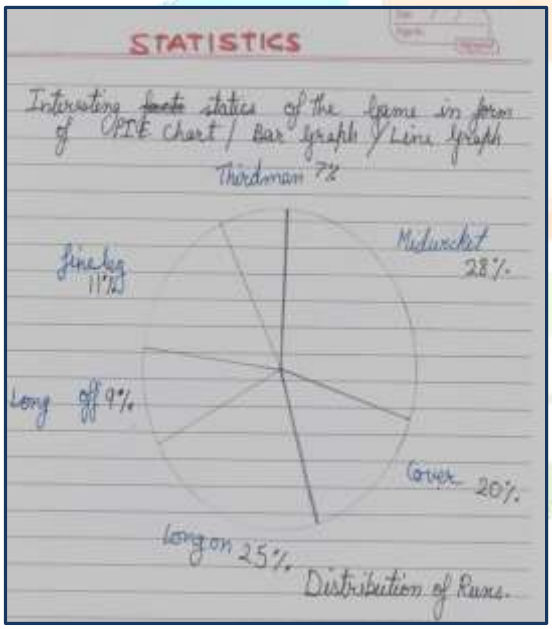
The comparison of assessments is as following:



COMPARATIVE RESULTS

S.No.	Name of the Participant	Choice of Sports	Term 1 + Grade	Term 2 + Grade	Remarks
1.	Akash Verma	Cricket	244.89 A2	145.8 A2	Improvement in Overall performance
2.	Animesh Shukla	Football	205.5 B2	207.2 B2	Improvement in Overall performance
3.	Anushka Verma	Kho-kho	174.99 C1	187.77 B2	Improvement in overall performance
4.	Ayushi Yadav	Badminton	162.61 C1	154.91 C1	Maintained the grades
5.	Gaurav S Kasane	Gymnastic	173.29 C1	165.25 C1	Maintained the grades
6.	Jayant Sharma	Badminton	277.71 A1	269.98 A2	Self-motivated student with good Mathematical aptitude
7.	Kalpana Tolwani	Badminton	185.52 B2	184.31 B2	Maintained the grades
8.	Khushi Rawat	Badminton	223.27 B1	211.47 B1	Maintained the grades
9.	Manas Gupta	Cricket	210.75 B1	194.82 B1	Hardworking student and a cricketer
10.	Naman Ritesh Jain	Cricket	284.26 A1	284.1 A1	Maintained the grades
11.	Nandini Jha	Kho-kho	263.26 A2	256.68 A2	Maintained the grades
12.	Nishkarsh Jain	Foot Ball	267.74 A2	261.39 A2	Maintained the grades
13.	Rohit Shaha	Foot Ball	239.43 B1	233.77 B1	Maintained the grades
14.	Samriddhi Maheshwari	Badminton	262.78 A2	265.12 A2	Improvement in overall performance

15.	Shivanjali Saxena	Badminton	230.74 B1	215.84 B1	Maintained the grades
16.	Shreeya Mudaliar	Boxing	214.17 B1	219.5 B1	Improvement in overall performance
17.	Soumya Mishra	Kho-kho	270.7 A1	270.07 A1	Maintained the grades
18.	Tanay Nagarkar	Cricket	239.57 B1	242.15 A2	Improvement in overall performance
19.	Tejaswini Dubey	Basket Ball	192.18 B2	191.17 B2	Maintained the grades
20.	Tushar Lagalwar	Judo	124.81 C2	135.1 C2	Improvement in overall performance
21.	Ashutosh Ukande	Foot Ball	218.58 B1	226.34 B1	Improvement in overall performance
22.	Vanshika Rajput	Volley Ball	219.6 B1	233.07 B1	Improvement in overall performance



Mathematics assignment

General Knowledge assignment

On successful completion of The Nachiketa Project, the results made me ponder upon the fact- Will the adoption of this practice in our education system lead to a developed sense of achievement in our students, both scholastically and co-scholastically? If yes, we can navigate their intelligence and aptitude and allow them to excel in the field of their choice.

Now with the proposal of the New Education Policy 2020, which is determined towards skill orientation in students and teachers, this Project can be modified and basic components of STEAM can be incorporated. Students can be given an internship-oriented assignment to be accomplished in a stipulated period of time. This is definitely going to make them self- reliant, help them realize their responsibilities towards their future and their place in the community and become adaptive.

INTEGRATION OF STEAM IN CURRICULUM

Integration of STEAM through Project based learning methodology will help students to critically analyze their in-depth knowledge and creative skills. It will also give them opportunity to appreciate their collaborative and managerial skills.

Let's try to understand the integration of STEAM in Middle Classes as following:

Class: VI
Problem: To construct a device used by submariners to locate position in the sea/water.

1. **Science:**
A student will be studying about the concept of reflection which is already part of the curriculum. The student will also be acquainted with the terminologies related to the reflection of light.

2. Technology:
The student will try to identify how can he make a good periscope and will look for good resources, material and technology available to make one such Periscope.

3. Engineering:
The student will go through all the pros and cons of making a good Periscope. The student will also try to search what are the various shapes that can fulfill the application of a good Periscope.

4. Arts:
The student will arrange for the material needed to make a Periscope. The student will also try to make it aesthetically appealing. Designing of a Periscope, its visual presentation and colour combination would help a student to nurture creativity.

5. **Mathematics:**
The student will have to use mathematical ability to construct a Periscope. He will have to measure the size of mirrors required, the positioning of mirrors and angle that mirrors would make with each other and the size of openings at the ends; all this would need mathematical aptitude, knowledge of geometrical shapes and it's the formulae used, etc.

ASSESSMENT OF SUCCESS OF INTEGRATION OF STEAM BY A STUDENT

1. Students can be asked to submit a report of how the components of STEAM are integrated in the project.

2. Report can be assessed on the basis of the following parameters:
   a) Conceptualization
   b) Resource management
   c) Technology applied
   d) Aesthetic appeal
   e) Designing features

3. It depends upon the Instructor how many points can be assigned with every parameter.

4. It would be appreciable of the instructor to provide a *Certificate of Accomplishment of Project* to the student. It will enhance the confidence level of the student and further motivate to perform much better.

5. Integration of STEAM to next higher level should always be there so as to keep the student engaged with the experimentation and construction processes.

This is just an instance to demonstrate how integration of STEAM can be incorporated from Middle School Level. Cross-curricular approach in growing years of education will help students in making them curious, confident, research oriented and would also empower them to handle resources and situations. They will be allowed to explore their capacities, develop their creative skills and enhance collaboration techniques. It is well said **उद्योगो नरभूषणम्** - Being industrious is the pride of humans and this can be achieved effectively by Integrating STEAM
in schools.

REFERENCES:

1. Pandit, N. (n.d.). The Separation of Friends. In *Saral Hitopadesha* (pp. 129-130). Rajpal and Sons.
2. Google for images and shloka.