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Developing the Scientific Temperament in the Children at Early Schooling Age

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ABSTRACT

Teaching-learning process is the most important pillar of any school which defines the academic success of the school. Monotonous ways of completion of syllabus and homework leads the majority of the students taking the studies as a burden and no way helps them out in their knowledge building. In the present research, the researcher discusses about the strategies that has been implemented in a school, which has rationale for each and every classroom teaching subject and topic. The researcher identifies the ways of various type of skill improvisation techniques that articulates the learning and adds on many related topics to know without any burden. The school, that implements such practices at very early age of schooling, definitely directs the students' engagement positively for the learning.

KEYWORDS: *Conceptual clarity, Scientific temperament*

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INTRODUCTION

Children, as seen these days, start their schooling at very early-tender age of 3 years as a tiny toddlers in an informal format of schooling called playhouse, wherein though they are formally sent to play or being looked after in the absence of their working parents for the précised set of hours, still the facilitators (teachers), people working there, keep trying to register many things in them as a part of learning. Children, introduced to formal learning at this stage, somehow get burdened of processes of formal education. With respect to constant changes in social structure, say from joint family to the nuclear one, working parents don't have any option for their kids to look after at home, hence they enroll their kids to kindergartens. As mentioned above, many writers and researchers, like Clark & Kirk, 2000; Rothenberg, 1995; Gullo, 1990, have mentioned that this change in academic setup has come up due to change in social and familial demands.

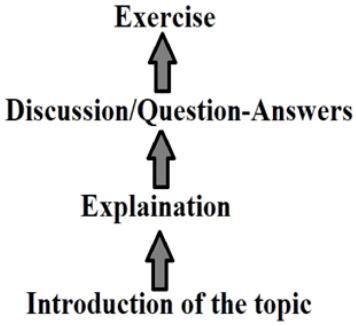

Fig 1 Vertical thinking map of teaching

Children at the age of kindergarten and then primary schools are not just taught the academics but they are catered to learn many behavioural skills, discipline, moral and ethical values and many more rules-regulations too. The children are mainly dealt with a set of planned fine motor skills, gross motor skills activities that help their overall development of not only physical well-being but also their psychomotor strengths.

The researcher, working also as a principal of Vishwabharati English Medium School, has always been busy planning the entire academic and co-curricular activities that help the students understand the content with least efforts still very clearly. At the very early age, i.e. from grade 1 and onwards, there are mainly three subject areas which are to be focused very clearly, i.e. Language, Mathematics and Environment. At this age, the comprehension skills of children mainly depend on the conceptual clarity of various topics. Students in the schools are mainly loaded with 'completion of syllabus' right from the beginning wherein the teacher has to get stuck to the given content in the set of textbooks selected by the school. Hence, in the race of completing the syllabus, the crucial element to gain the 'conceptual clarity' is 'context' and that is what found missing in the textbooks. Getting deeper into it, this gap actually, is combination of various aspects, like,

1. the presentation of the content in the textbooks,
2. the way teachers deliver it in the classroom and
3. how do the educators treat the school curriculum.

Hence, the researcher started planning to work upon various teaching practices/strategies that can help improvising the learning process and retaining of the knowledge thoroughly. Researcher basically noticed the practice of Vertical thinking in the classroom teaching, wherein the teacher follows the steps shown in Fig.1 that leads from introduction to exercise of any topic.

The main thing, here, is that the entire process, shown here, mainly revolves around the textbook content which may be very limited and lead to know just about the given content. The researcher, being a principal, has been always getting into discussion with the teachers for the concrete solution of the same. Researcher could clearly notice the lack of the scientific temperament in the students of the middle primary grades of his own school and he could relate it with the learning gaps at the primary level, making them struggle to cope up with their studies.

According to an argument by Dhar (2009), scientific temperament can be characterized mainly by following traits,

1. Healthy skepticism
2. Universalism
3. Freedom from prejudice or bias
4. Objectivity
5. Open mindedness and humility
6. Willingness to suspend judgment without sufficient evidence
7. Rationality
8. Perseverance — positive approach to failure

Moreover, the researcher feels that scientific temperament mainly deals with keen sense of observation. Instead of looking to the face value of any instance or thing, the person actually tries to know about 'why' and 'how' for it. The person with scientific temper is proactive, not passive, towards problem solving, working out on new solutions for the problem. According to Bhat, 2011, even the artisans of small village, who have very limited resources are seen quite pro-active towards problem solving approach. And this can be definitely attributed to their observation skill and curious behaviour to any problem come up.

So, in order to imply same thing into practice, the researcher held various meetings with teachers and held prolonged discussions about improvisations in various teaching-learning practices for the students of primary grades, i.e. std. 1 to 8, the researcher designed a special working pattern which he wanted to imply gradually after the detail planning, discussion with teachers and their feedbacks regarding the same.

Topic

Developing the scientific temperament in the children at early schooling age.

Objectives

Researcher had following objectives for the improvisation of teaching-learning process of the students.

1. To improvise teaching processes that can give conceptual clarity in any subject taught.
2. To improvise the observation skills of the students.
3. To help them understand the topics and the content related to it.
4. To develop scientific temperament in the students.
5. To develop comprehension skills in the students.
6. To inculcate decision power in the students.
7. To improve confidence level of the students.

Planning and Procedure

The researcher mainly divided this project in three areas,

1. Languages – working on comprehension, reading, speaking, writing & listening skills
2. Environment – Observation, having hands on experiments, relating with nature
3. Mathematics – Numbers to basic operations, shapes and basic concepts

Accordingly, the researcher started visiting regular classes of the teachers for observation and started noting down their strengths and areas to strengthen still. Researcher divided the group of the teachers into two –teachers teaching languages and teachers teaching mathematics and science.

After several meetings and close look to the syllabus, the researcher designed various projects for students, which are as under:

1. Science labs from grade 1
2. Hands on tools
3. Knowing by doing
4. Exploring Library

Execution:

By introducing such ways of teaching, it is expected to induce the learning without any formal syllabus, conceptual clarity, interest in learning and to inculcate scientific temperament for anything they do. The researcher executed the entire work as under.

1. Science labs from grade 1.

Students from grade 1 to 8 were given 2 days of laboratory visits per week in the timetable. In the initial months of the year, i.e. June and July, for grade 1 to 4, lab visits are planned. Teachers take them to the lab, helping them to identify the labs as Physics lab, Chemistry lab and Biology lab.

A. Lab Visits:

- **For Std. 1 to Std. 3**

The following steps are taken for it.:

- Teachers make them understand that the lab with various apparatus of measurements, glass slabs, mirror/lenses or balances is a physics lab.
- The lab which contains with chemical bottles, burners, charts of periodic tables is a chemistry lab.
- The lab having microscopes, slides, specimens of plants and animals and various charts hung on the wall showing organ systems and all is a biology lab.

The basic objective behind these visits is to help them identify various labs separately but the hidden agenda is to make them know that there are three branches of science, i.e. physics, chemistry & biology.

B. Learning measurement at younger age:

For the measurement, units are generally introduced in grade 5th and onwards. This activity aims to help students relate the size and shapes with their measurements using basic units at least.

Illustration: 1

Teachers ask students to measure their notebook edges with a geometry box scale. Students would be obviously knowing about basic numbers so they do these activities with great enthusiasm but they can tell the length just in numbers without any unit. So, after getting answers from few students, the teacher would make it clear that it is not just 12 but it is 12 centimetre. Same way, the teacher asks them to measure their bench with a wooden scale and inform them

that it is measured in feet. Accordingly, in next lecture they are taken to the school corridor and are asked to measure the length of it with a rope, helping them to understand the unit metre. Teacher also asks question about the distance of two places or cities and if any child answers the umber with the unit kilometre, she picks it up and explain that the bigger distances are measured in units.

C. Measurement and precision relating to basic number operations:

One more strategy to teach students measurement at very early age, it is also planned to teach them basic number operations as well as precision to conduct the activity. Following are few examples.

Illustration: 2

For this, teachers take students to chemistry laboratory and give them plastic vessels like, burette, pipette, measuring cylinders and beakers. To work on their precision, teacher asks students to fill the measuring cylinders or beakers with water without spilling of any drop. All the students get this chance to perform this activity. Simultaneously, the teacher asks them about the amount of water they filled in, couple of students might answer to this and that too without any units (obviously). Teacher introduces the units of fluid hereby in an informal discussion that help them to know about it.

Then the teacher continues the activity to transfer water from big measuring cylinder to the smaller one and asks how many small cylinders can be filled? Here, the observation skill also helps as the teacher has already displayed cylinders of 50 ml and 25 ml nearby a 100 ml cylinder. Couple of smart students can guess from the size and teacher allows them to do it on their own to confirm if they were correct. This helps them to understand the division of a greater number into smaller one as well as the precision to handle liquid while transferring which again can be included in their fine motor skills leading to their psychomotor development.

Illustration: 3

Same way, they are taken to the school garden where they are introduced to various plants and help them to identify it. The teacher asks them to talk about the difference in two plants which are close by. This, actually, demands the observation skills as well as establishes the understanding about the various characteristics of the plants. Teacher informs basic details of plants and its parts. The students are asked to collect 5 different leaves (fallen) which they need to bring to class and stick into their science experiment book. They are asked to draw an outline to that leaf and teachers teaches them how to label it. The activity clearly involves knowledge about plants, observations skills, craft work to stick leaves and drawing outline along with the precision in all of these.

➢ **For Std. 4 to Std. 8**

The teachers, who teach Environment/Science in std. 4 to std. 8, sit together with the syllabus and plan out the activities and experiments that can help students to understand the concepts well. For designing the syllabus, the entire chapter line up is kept in mind and designed activities in mainly following ways.

1. Lab experiments
2. Classroom activities
3. Demonstration of experiment
4. Poster preparation & Presentation

The teachers, working in this pattern, also ask students to write the experiments in a formal way in the practical book, helping them to take notes of their practical work in an organised pattern. Students are clearly instructed about the entire working of the experiment so that they would not miss out any important aspect. Moreover they are taught to write the readings/observation in observation table and conclusion.

* **Virtual Science Laboratory**

This project is a spontaneous one, designed with less human resource without any pre-plan, to meet the learning needs and make the science learning better. So, the researcher has prepared the videos of lab introduction of physics lab, chemistry lab and biology lab within the school only so that students of std. 1 to std. 3 would not miss their lab introduction session and these videos where shown and explained with all these students during online classes during Corona time when the school were physically closed. The links of introductory videos are here for the reference.

A. https://www.youtube.com/watch?v=wF2lX3r4GOU (a virtual tour to chemistry lab)

B. https://www.youtube.com/watch?v=hwP39YwPm4k (a virtual tour to biology lab)

Same way, the researcher prepared videos of experiments, which before corona pandemic were done in lab. This videos helped teachers to explain the content and overcome the constraint of science lab experiments at some extent in online teaching. The links of couple of them, for the reference, are as under.

A. https://www.youtube.com/watch?v=V4yeM2gC9HI (Does air occupy space?)

B. https://www.youtube.com/watch?v=Xx4xaRy2JF4(to know water holding capacity of soil)

C. https://www.youtube.com/watch?v=HTFKka4qD7M (Types of magnets & its properties)

2. Hands on tools

Hands on tools is an another interesting activity introduced in the school for the students of std. 1 to 9. This activity requires involvement of teachers as well as students of various age at the same time. The entire planning of the activity is as under.

A. The class teachers of std. 1 to 9 divides their class students in pair of two each, i.e. pair of roll no. 1 & 2, roll no. 3 & 4, and so on.

B. The students of lower primary group, std. 1, 2 and 3 is clubbed with the middle primary school students, say std. 4, 5, 6 as well as with upper primary-secondary school students of std. 7, 8 and 9. Specifically, the pairs are made as shown –

For Set I teams: Std. 1 – Std. 4 – Std. 7

For Set II teams: Std. 2 – Std. 5 – Std. 8

For Set III teams: Std. 3 – Std. 6 – Std. 9

C. Within the sets, 2-2 students are picked up from each of the three grades as per their roll numbers and the team of 6 is created. i.e. roll no. 1, 2 from each of the std. 1, 4 and 7 makes a group of 6 students, same way roll no. 3, 4 and so on. Std. 2, 5, and 8 also plan groups same way and Std. 3, 6 and 9 as well.

D. Hence, in each group of 6 students, there are 2 students from lower primary, 2 from middle school and 2 from upper primary-secondary school, making each group very diverse and unique with reference to their competencies and potential.

E. Each group is given a simple scientific tool, apparatus or toy/working model which is very easy to make and it has a concept on which it is functioning or working. (Ref.: http://www.arvindguptatoys.com/toys.html)

F. The division of labour is done in all the groups, like, the model is to be made by the youngest two students of the group, the elder most two students have to help them in making as well as explaining the scientific concept clearly while the two students of the middle school represent them on a poster or chart making their diagram and explaining its principles.

G. The entire team works together and prepare a clear presentation in the Science fair or exhibition demonstrating their model or tool to the teachers, other students and visitors.

Here, the activity has far reaching results which are not apparently visible too. The activity doesn't only bring the knowledge but also induces importance of collaborative work, peer learning and craft/drawing. It helps elder students to learn lessons of leadership and creates harmony among the students of various age groups.

3. Knowing by doing

A very well known approach 'Knowing by doing' is less put into practice where in schools are busy with monotonous teaching, using lecture methods, exercises and homework. The researcher in the school plans various events where in the students are to plan everything with the help of their class teachers and student-teacher support committee. One such example is as under.

Illustration: 4

The students celebrate the cultural event every year wherein they work according to various themes selected for it. All the classes work under the same umbrella of main subject selecting sub themes for each of them on their own. Few examples are as under –

A. Year 2016: Earth, my home (where the students performed dances and dramas of various parts of the world)
B. Year 2017: AmoAabad in Ahmedabad (the journey through a city history from its establishment to the contemporary growth)
C. Year2018: The rising Billion (A story of growth of Indian Economy and its various aspects)
D. Year 2019: SahityakaSafarnama (a journey through various national literatures and of the world)

Apparently simple looking above activity, actually, involves students in depth touching upon many subjects and learning of many textual and non-textual matters. The list, the students do here and learn is as under:

- Students finalise their own class theme – includes linguistic skills of discussions and debating also sometime to put forward their own idea.
- To research on given theme on their own or in group, help them unknowingly go through many related topic also.
- Writing the script of their own drama or introduction of their dance demanding the writing skills as well as keeping the relevance with the theme in the mind.
- Students would have to prepare one piece of art as a Stage Craft made up of plastic, craft paper, thermocol sheet or plywood. For which they need to estimate the size, required material, need to write a demand not to principal and to make the model too. It involves their mathematics for measurement, estimation skills, craft and engineering skills to assemble and working in group.
- The students of each grade has to decorate their own classroom according to their own presentation with charts, pictures, artefacts and information a day prior to cultural event so they learn a smallest bit of the item they are going to perform, hence, their knowledge increases.
- Students record their skits, dramas and narrations and sync music with it which gives them exposure to technology usage as well as understanding to develop visual arts and performances.

All in all, the cultural event is actually an opportunity to learn various subjects in a perfect blend.

4. Exploring the library

A good library is an asset of the school. The books, journals, magazines and research works stored are the treasure of knowledge that anyone within the school can get benefit of. Library plays an important role in the life of a student. The report of Ross Todd and Carol Kuhlthau's (2005) mixed methods study in Ohio mentioned that nearly 13,000 students stated how the library helped them in various ways. Many students reported that library was the resource for them to understand the steps for finding and evaluation various information, they wanted to study about.

In accordance to above, the researcher has also introduced a plan, Exploring the Library. The entire plan works as under.

- The class teacher reads a book and talks about it with the students in home period so that students get to know about new books.
- The language teachers are instructed to take one of their class during a week in the library when the children knowingly or unknowingly come across the various books, titles of magazines and picks it up out of curiosity.
- Language teachers also demands a personal 'Vocabulary Notebook' by each student, that helps them get familiar with new words and help them comprehend the unknown texts.
- Students are encouraged to borrow books from library and they are allowed them to carry it home for a week.
- The librarian also plays an active role in this and keeps reading the books in the free time. The student, when comes to deposit the book back, the librarian asks his views about the book.
- The librarian also asks some questions from the book to ensure that the child has read the book. Each child who has borrowed and read the book gets a remark on the special page at the end in the school diary.

- The librarian also records the review of the students and uploads it on the school channel which motivates the student to read more and promotes other students also to read. Two such video links are given here for the reference.
  A. https://www.youtube.com/watch?v=wGhr9HIKwi8
  B. https://www.youtube.com/watch?v=Z5t_RRia1JI

Outcomes:

Success of any study or research plan is mainly dependent on its results, outcomes or analysis. Since this was a long term strategic plan of improvising teaching-learning processes of a school, a statistical analysis of short-term data would not portray a clear picture of the plan. So, the researcher have conducted meetings with following groups and noted their feedbacks.

A. Students
B. Teachers
C. Parents

1. Students' feedback

Students of grade 1, 2 and 3 couldn't put their feedbacks in the words still they all expressed that they enjoy coming to school. When asked which activity you like the most in the school, the reply to this question was, going to laboratory as well as classroom activities. This clearly indicates that 'Learning by doing' make them positive for the study and increases students' engagement in the teaching-learning process.

Students from grade 4 and above, could clearly express their views where 85% students expressed that they understand what is being taught in the laboratory. More than 80% students responded positively for the 'Hands on tools' activity and they said they could learn about the model of their own as well as the models made by other students within the class.

2. Teachers' feedback

Teachers were asked to share their precise reviews in terms of various aspects. The summary of the reviews of teachers are as under.

- Have become enthusiastic for learning.
- Shows their interest in the subject while taught, started showing engagement.
- Have started responding the questions.
- More than 70% of the students have started thinking logically with due reasoning during activities.
- They have become particular in performing activities.
- Their observation skills have been increased.
- The skill of craftsmanship is seen improvised in nearly 75% of students.
- Number of the students, visiting library, have been increased, showing up their interest in reading.
- The students are having more comprehension skills due to increased use of library, enhancing their linguistic skills as well.
- An increase of 20% more than the previous is seen improved in their class work and note taking patterns, making them more clear, presentable and particular.
- Students' knowledge bank is also improvised due to teaching of various fact and concepts which are not mentioned in their textbooks.
- Students have been seen improving in basic mathematical operation due to regular practice in school, dodging of tables and mental maths.

3. Parents' feedback

Feedbacks of the parents were taken during 'Open House' by giving them feedback questionnaire. Many parents personally talked regarding their opinion about their ward. The views are as under:

- Their ward started liking the school and don't want to miss the school even for a day.
- The child has become more attentive and finishes the work on own.
- The result of the child has been improved.
- The child has started talking about the daily activities done in the school.

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