

Qualitative Analysis

The next step after the data collection is over, followed by the compilation and organization of all the data transcripts, and is the most crucial step in the research, is the *Analysis* of data. The present research involving a qualitative approach, requires an in-depth, comprehensive understanding of the analyst, as compared to the quantitative data analyst's role which is sufficed by serving as an investigator of particular relations among the discrete variables (Denzin & Lincoln 2000; Patton 2002).

According to Given (2008), Qualitative methodologies adopt a specific research approach for designing their studies, collecting and analyzing data. This is found to be a combination of several philosophical perspectives, postulates, assumptions, and approaches which can be deployed by the researcher for the analysis, critique, and/or adaptation of his research (Given, 2008).

The two most fundamental approaches for analyzing the qualitative data: *deductive approach* and the *inductive approach* (Spencer et al., 2003). As stated by Williams et al., (2004), when the researcher imposes his own structure or theories on the data and then uses these to analyze the interview transcripts, the approach used is said to be deductive. While, the analysis of data with little or no predetermined theory, structure or framework and using the actual data to derive the structure of the analysis, is termed as following the inductive approach.

The Deductive content analysis approach is used when the purpose of the study is theory testing; when the structure of analysis is operationalized on the basis of previous knowledge (Kynga's & Vanhanen 1999). However, pertaining to the features of qualitative research as explained by Merriam (1998), there is a predominant interest in understanding the meaning people have constructed, and an inductive approach to knowledge generation. The present study solely depends on the data transcripts for extracting the relevant themes and structure of the research, and therefore adopts the inductive approach for qualitative analysis of the data collected.

Out of the various methods available for analyzing qualitative data, the present research has followed the thematic content analysis method. As stated by Lincoln and Guba (1985), data analysis in a naturalistic inquiry is open-ended and inductive. Thereby implying that data analysis begins during the data collection process, and continues after the collection is complete. Therefore, in line with the aim, the present research methodology involved analyzing the data transcripts, so as to identify the emerging themes and further, gathering examples of those derived themes from the transcript text.

The data analysis process included three major steps; namely, open coding, creating categories and abstraction.

1. Initial Stage:

Open coding involves writing notes/headings in the text while reading it. According to Burnard (1996) and Hsieh & Shannon (2005), the process involves reading the written material several times, and writing down as many headings as possible in the margins to describe all aspects of the content. Thus, the text was converted into single phrases for arriving at keywords symbolizing the specific portions (by highlighting the text portions). A similar technique of *Pawing*, was applied involving underlining the text using colored highlighters to highlight the main texts (Sandelowski, 1995). These techniques were majorly focused on the particular sections from which abstraction was possible, so as to offer a conceptual understanding of the text.

The following broad coding framework (Overall Theme of Transcript portions) was derived in the initial phase of Textual Analysis:

Demographic Profile
Qualities/Values/Behavior required in Teaching
Plus points for science teacher
Experiences that facilitated Opting Science
Other schools v/s single sex schools (Points of Similarity)
Other schools v/s single sex schools (Points of Differences)
Motivation towards single sex school
Role of Teacher's upbringing/schooling
Factors that shaped Personal conduct in professional/personal life
Obstacles/constraints in school teaching
Change in student demographics while teaching experience
Challenges due to change in demographics in single sex schools
Success as a teacher (students perspectives)
Strategies for Disabled or challenged students
Support from admin/teachers
Staff Development
Support from parents
Resources available
A good learning environment
Testing in present scenario v/s earlier
Secrets to success of teachers
Alternatives to standardized testing
Deficiencies of standardized testing
Accountability concerns

2. Second Stage:

The next stage entailed a rigorous reading and comprehension of the data transcripts, so as to extract all the minor details of the key areas covered during the telephonic interview sessions. This step involved the identification of the topics repeated in all the transcripts pertaining to the above mentioned emerging themes. These derived key areas can be termed as the '*informative tools*', which were used for extract the required information from the participants. These can be considered as the major ingredients to answering the research questions. These topics or information was discussed in differing chronological orders for each of the teachers interviewed. The table presented below is one step further in the process, and has combined or clustered the similar emerging themes, according to the conceptual similarities. The aim was to create a detailed structure of the emerging themes, along with its segregations into its various sub-themes. An important point to be noted here is that there could be several clusters created out of the identified sub-themes discussed, however, the present clustering has been done according to the research questions and objectives considered for the present research.

A detailed coding framework for the above mentioned broad themes (initial stage), can be presented as follows:

Demographic Profile	Subject
	Highest Educational Qualification
	Teaching Experience (in years)
	Teaching Experience in girls school (in years)
Qualities/Values/Behavior required in Teaching	Self-disciplined
	organized
	Determined, motivating
	A routine/procedure for teaching
	Patience
Plus points for science teacher	Content Knowledge
	Experienced in carrying out experiments
	Engagement in science fairs
	Good communication skills
Experiences that facilitated Opting Science	Wanted to be a doctor
	Exploration, Outdoors
	Knowledge about world
	Tested Knowledge
	In-depth knowledge
	Engaging/hands-on
	Science is constantly changing (constant learning)
	Motivated by teacher (role model)
Other schools v/s single sex school (Points of Similarity)	Students learn in the same way
Other schools v/s single sex school (Points of Differences)	Girls share more with teachers
	Girls learn more
	Girls raise own voice, ask questions
	Boys are more focused
Motivation towards single sex school	'New' type of school
	Studied in girls school myself
	Wanted to contribute towards the need for motivation in such schools
	'Gender thing'
Change in student demographics while teaching experience	Not much change
	Composition by different origins
	Failure chain

Challenges due to change in demographics in single sex schools	No value of education among some
Obstacles/constraints in single sex school teaching	Lack of resources, materials required for science
	Lack of space
	Lack of infrastructure (labs)
	Lack of strong foundations in math
	Lack of motivation
	Classroom management
Success as a teacher (student's perspectives)	Students enjoy class
	100% passing
	Extra time devoted after school
	Help on Saturday/off days
	Don't like me, but my job is to only teach
Secrets to success of teachers (teacher's perspectives)	Every student can learn
	You can teach them how to learn
	Using plans, being organized
	Using resources, technology
	Convince students of relevance what they learn
	Make science easy and simple
	Good observation
	Appropriate lessons to support learning styles and abilities
	Teach what they love, passionate
	Offering Real life experiences
	Constant learning as a teacher
Factors that shaped Personal conduct in professional/personal life	Value assigned to education
	Being a part of the same society
Role of Teacher's upbringing/schooling	Behavior shaped by family values
	Family Relations are important
	Sense of Responsibility in duty
Resources available	LTF, Laying the Foundation
	STEMscopes
	Adaptive Curriculum (online)
	hands on activities
	gizmos
	UT online homework
	Google maps, TOPO maps
	PowerUp school with laptops
Support from admin/teachers	Arranging lab materials,
	Plan together
	PLCs every week

	Common curriculum/ curriculum teacher
Staff development	Waste of time, boring
	Repetitive, happens each year
	Training to be more teacher-focused
	Teacher's feedback must be taken
Support from parents	Concerned about students
	Active in parent conferences
Strategies for Disabled or challenged students	More engagement with Labs/Hands-on
	Motivation, appreciation
	Cooperative learning
	Extra time
	One-to-one teaching
A good learning environment	Understanding the level of students
	Student's learning styles
	Strengths and weakness of students
	cooperative learning
	Interactive
	Project based learning (PBL)
	Independent learning even in group work
	Inculcating the urge to ask questions
Addressing learning styles	Powerful learning through Failure
	Focus on Vocab learning
	Attention to understanding of questions
	Innovate with the blackboard
	Using various resources for the formative assessments
	Creative use of textbooks
	Engaging the students through relevance
	Experimenting with Reading and writing
Deficiencies of standardized testing	Need for both informal & formal assessment
	Some students Lack good test taking skills
	Do not represent students' knowledge all the time
	Suffer from lack of reliability due to lack of interest
	No in-depth knowledge
	Lack of practical knowledge, due to test curriculum
	Narrow down knowledge to only test syllabus
Alternatives to standardized testing	Daily observance must

Accountability concerns	pre-test and post-test
	Informal assessment gives better idea of effort put in
	Teachers are accountable to some extent
	Terrible to blame teachers
	Examination structure is absurd

3. Third Stage:

The final stage of thematic content analysis, consists of the selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a report of the analysis.

In the final stage of data analysis, detailed abstraction was done with the aim to support the emergent themes. Each emerging theme was allocated its sub-themes, which were further substantiated by exact quotes or extracts from the data transcripts. The four participants considered for the present study will be addressed as 1, 2, 3, and 4.

Demographic Profile

Demographic Profile	Subject
	Highest Educational Qualification
	Teaching Experience (in years)
	Teaching Experience in girls school (in years)

All the teachers were found to be teaching science and its related subjects, including zoology, biology, and chemistry. They were found to be holding high degrees of post-graduation and doctorate in the related subjects.

3: *"Yes, I completed my master's. I had my bachelor's degree in zoology honors. That's a part of biology. Then I completed my master's in entomology. Then I pursued my doctorate degree in biology only."*

Their teaching experience ranged from 10 to 25 years. A noteworthy finding from the present research indicates that all the teachers were found to be extremely passionate about the subject they taught. As stated by one of the teachers:

3: *"Basically I breathe, I eat, I do biology."*

Qualities/Values/Behavior required in Teaching

Qualities/Values/Behavior required in Teaching	Self-disciplined
	organized
	Determined, motivating
	A routine/procedure for teaching
	Patience

The teachers pointed out to several qualities or values which must be present in teachers teaching science.

Patience was seen to be an important ingredient to a coherent behavior for teacher a complex subject like science. Major focus was laid on transmitting the indispensability of science as a subject for teaching ways of life.

3: *"First thing is I try to convince them that science is needed for you....I make it very clear to them that this is really important and you need to learn it in some way that you will be successful using this. It will make you successful if you use this in your future."*

It was stated that a science teacher must always be in a constant touch with the students. The teacher must be determined, and full of zeal for succeeding in the subject.

3: *"I'm always there formatively and summative assessing them. I always encourage them, motivate them, never give up."*

Practically, applying this behavior to the subject of science, it was stated:

3: *"When we first make our hypothesis, if we do not get to what is needed or what is supposed to be our conclusion, then we go ahead and rewrite our hypothesis. I always give them opportunity to do it and learn it."*

Plus Points for science teachers

Plus points for science teacher	Content Knowledge
	Experienced in carrying out experiments
	Engagement in science fairs
	Good communication skills

Certain

characteristics were identified which particularly benefitted the teachers in their daily teaching the class. One of the major factor which was reported to be advantageous for the teachers was their content knowledge of science as a subject, through their qualifications in the subject. This was also related to their prior experience in carrying out experiments.

2: *"One of the things is my content knowledge, my PhD, which gives us a good exposure to hands on experiments where you learn from your mistakes, and you do the experiments. Same thing I used in*

classroom also as a science teacher where the students are learning by doing the experiments which motivates them a lot.”

Organizing and participating in science fair was seen to be an added advantage, for convincing the students of the relevancy of science subject in their daily life.

1: *“Also, we are also involved in science fair. We do the projects that involve students and where they can learn that how the science is used in real life.”*

The most important initiative which can be taken by a teacher to enhance the teaching learning experience, was reported to be increased communication with the students and parents.

3: *“This has made my life easier, and I started communicating more with the parents....I try to motivate the kids. I ask for their cooperation. That has helped me a lot.”*

Experiences that facilitated Opting science

Experiences that facilitated Opting Science	Wanted to be a doctor
	Exploration, Outdoors
	Knowledge about world
	Tested Knowledge
	In-depth knowledge
	Engaging/hands-on
	Science is constantly changing (constant learning)
	Motivated by teacher (role model)

The very nature of science being a subject involving constant learning, active participation of the learner, experimentation and practical aspects, was noted to be a major motivation for the teacher to have joined science teaching as a profession.

2: *“Science is like hands on which motivates students, engage them. Science is more engaging.”*

4: *“I think science is something that's constantly changing, you have constant learning what's new. I mean Pluto was a planet when I was taking science. It's no longer considered a planet. Why? There's a whole bunch of things that change on a regular basis in science, so you have to above with it.”*

The influence of the teachers in the schools in which these teachers' studied were also found to be a great source of motivation for them.

1: *“He had such an impact on me because he had the practical aspect. He brought biology to life.”*

Other schools v/s single sex schools (Similarities and differences)

Other schools v/s single sex school (Points of Similarity)	Students learn in the same way
Other schools v/s single sex school (Points of Differences)	Girls share more with teachers
	Girls learn more
	Girls raise own voice, ask questions
	Boys are more focused

The analysis reveals that although the teachers felt that the students in both the school learnt in the same way, they were found to be more comfortable with the same gender classroom, especially the girls. The girls in single sex schools were reported to be more vocal, confident, and sharing a close relationship with the teachers.

2: *"I feel that students learn the same way whether it's mixed community or single gender like girls school, but one thing I've found different in girls school is the girls, they share more with the teacher when single gender than the mixed gender."*

Motivation towards Single sex schools

Motivation towards single sex school	'New' type of school
	Studied in girls school myself
	Wanted to contribute towards the need for motivation in such schools
	'Gender thing'
	Peer-reference

An interesting finding related to the motivation for female teachers to teach in a single gender school, was reported to be receiving education in only girls schools in their childhood. As stated by one teacher

2: *".....and I felt that as a student, I used to feel more comfortable going to that school, but there were some things that I always used to think they should be more than that like in my time, so I thought in the girls school, I will be able to do a few things like experimenting, using technology, and maybe motivate them."*

Thus, comfort as a student, in single sex school was noted to be a major reason for perceiving teaching in such schools also as comfortable compared to a mixed gender school.

Whereas, on the other hand, the male teachers were found to be claiming that the decision to join a boys school was something associated with their 'male thing'. This also meant that they were against joining a girl's school as they asserted that it is meant only for the female teachers.

1: *"I didn't think about the girls school. I thought about the boys school, because, you can call it what you want, but it must have been a male thing. I thought they only hired women at the girls school."*

However, a majority claimed that they did not intentionally join a single sex school, but were referred by a colleague, or friend working in the same school.

3: *"I have been teaching science in US for 13 years, as I said. Nothing has motivated me, but I was selected by one of my friends to work with them in the single-gender school."*

Change in student demographics while teaching experience

Change in student demographics while teaching experience	Not much change
	Composition by different origins

The teachers had an experience of teaching students from diverse backgrounds. The single sex schools were reported to be teaching students from varied backgrounds, cultural groups, social groups, and economic classes.

2: *"I have taught in like Hispanic communities, black and white community."*

The teachers claimed that there was not much change in the demographic composition of the single sex schools; or rather, it was static. The schools saw a mix of African Americans, Mexican Americans, Asian Americans, Hispanic Americans, Caucasian as well as Indian students.

1: *"There's only been a very slight change in the demographics..... The demographics are basically static."*

Challenges due to change in demographics in single sex schools

Challenges due to change in demographics in single sex schools	Failure chain
	No value of education among some

A particular characteristic about the single sex schools was revealed by the teachers which poses to be the greatest challenge for the teaching-learning environment and success in such schools. The research points to the finding that the student's family history presents a kind of 'failure chain' associated with it, wherein the parents of such students are found to be illiterate or 'out-of-school' at early stage of education. This environment was appropriately described by one of the teachers as follows:

1: *"A lot of these kids, they're in an environment where there's a failure chain. Their parents didn't go to college, a lot of 'em may not have finished high school, or didn't do well in high school. They're looking at their children to get educated because they believe education will get them out of poverty. Or get them out of the failure chain."*

A major challenge noted by the teachers, was the lack of a sense of value of education, especially among the African American students. However, the girl students coming from Mexican American background were an exception.

1: *"I'm noticing the African American students, not as a whole, but there's a small majority there that not quite getting the value of this education. Especially, in this environment. This all girl school."*

However, this too was linked to the concept of failure chain, wherein the value of education was not understood by the students since their parents were uneducated.

1: *"I think, it's a cultural thing. You have those students, again, they're in that cycle where their parents haven't gone to school, so they don't understand that value. They don't have that role model at home."*

Obstacles/constraints in single sex schools

Obstacles/constraints in single sex school teaching	Lack of resources, materials required for science
	Lack of space
	Lack of infrastructure (labs)
	Lack of strong foundations in math
	Lack of motivation
	Classroom management

The teachers reported that the major obstacles to teaching science in the girl schools were those imposed due to the financial constraints. Lack of resources, lab materials lab infrastructure, etc. were thus, reported.

2: *"I don't say that there were too many obstacles or constraints that stopped me from doing what I wanted to do, but sometimes, the resources, lack of resources, lack of space, like in science, you always need a lot of materials."*

1: *"You gotta have some degree of good equipment, when I say good equipment I'm talking about hardware, the laboratory apparatus that they'll be using, say in college and in industry. The microscopes, we've got those, you need the PH meters, the centrifuges, the incubators, things like that, the hardware. HSD is lacking in those areas."*

Classroom management was another obstacle identified for a conducive learning environment by the teachers. Bad classroom management was seen to hinder the process of knowledge transfer.

1: *"...the biggest obstacle is classroom management. You're not gonna get any transfer of knowledge if you don't have control of that class. If the class don't believe that learning is gonna take place there, nothin's gonna happen. That's the biggest obstacle."*

Success as a teacher (student's perspectives)

Success as a teacher (student's perspectives)	Students enjoy class
	100% passing
	Extra time devoted after school
	Help on Saturday/off days
	Don't like me, but my job is to only teach

As reported by most teachers, the students were found to be appreciative of the efforts of the teacher. The efforts included devoting extra time after school hours, giving coaching on weekends or holidays.

This appreciation was seen in the form of achieving high scores and enjoying studying during the class.

However, one of the teachers also showed a rather cold attitude regarding his relationship with the students. This is an indication of the lack of connection between the teacher and students, and a lacking interest, close relationship, responsiveness on the part of the teacher.

1: *"I don't think I've done very well with teachers that I didn't quite like, and kids are no different. Again, I know all the students doesn't like me, but I get through my day just the same. [Laughter] I got to keep on with the program."*

Secrets to success of teachers (teacher's perspectives)

Secrets to success of teachers	Every student can learn
	You can teach them how to learn
	Using plans, being organized
	Using resources, technology
	Convince students of relevance what they learn
	Make science easy and simple
	Good observations
	Appropriate lessons to support learning styles and abilities
	Teach what they love, passionate
	Offering Real life experiences
	Constant learning as a teacher

The teachers reported that being passionate about what they teach and loving it is a must for the teacher to be effective in his/her job. "Passion for the job", "love to share knowledge with kids", "if you

don't like teaching you shouldn't be in it" were used for describing the kind of attitude and passion needed to become successful teachers.

Strong Content knowledge, and being from the same field of education was noted to be an added advantage. Along with the content, the major task to be performed by a successful teacher is supposed to be following pre-determined, organized plans. The basic idea was that the teacher not only teach, but they can also determine how students learn.

A great focus was laid on creating a student-centered atmosphere for teaching and learning to take place. Appropriate availability of resources and materials, technological support, disciplined environment, relating the knowledge offered to real life experiences, were among the major secrets to successful teaching. A specific finding noted was the prevalence of a daily routine or style of teaching and learning.

Moreover, it was also listed out that the teacher along with teaching, must have a continuous zeal for learning new things, concepts, etc.

P4: *"The willingness to always continue to learn about what's new and different and what's changed."*

The one major secret to the success of a science teacher particularly, in the single sex schools, which was reported by all the four teachers sampled, pointed to the importance of indicating the association of text to the real life experiences of the students. For instance, a teacher stated that while teaching about density, the relevance of the concept of density and relating it to a real life experiment which helped her get her first job, was discussed in class. This helped the teacher in attracting the immediate attention of the class towards the topic.

1: *"The attribute that I think I bring to the teaching field best is that translating to a practical application. What does this mean to me? Why am I learning this? Because so many times I know in high school, kids will say, "Why am I taking this course? " You don't want to say, "Well, you need to take it to graduate." You want to say, "Well somewhere down the line you're gonna do this." I bring in the classroom examples...."*

Factors that shaped Personal conduct in professional/personal life

Factors that shaped Personal conduct in professional/personal life	Value assigned to education
	Being a part of the same society

As revealed by one of the male teachers, the fact that the teacher himself belonged to the same society from which most of the students at the single sex school (Boys' school) were from, resulted in an increased sense of association with the class. Such teachers were found to be more aware, responsive and empathetic to the varied needs of such students.

1: *"As far as the attributes that I think make me successful, I'm able to relate to the kids. I grew up as an inner city kid, and I know some of the pains that they're goin' through right now as teen agers. I try to make it fun, it's not always fun to learn science, and I try to relate to them on their level. They call me grandpa now."*

This similarity was also seen in the context of witnessing the same 'failure chain' and associations with the same social deprivations during childhood.

I've lived that. My dad couldn't have had more than an 8th grade education. My mom didn't go to college. I far exceeded their expectations."

Role of Teacher's upbringing/schooling

Role of Teacher's upbringing/schooling	Behavior shaped by family values
	Family Relations are important
	Sense of Responsibility in duty

The teachers valued the hard-earned money, and had a great belief about contributing their best towards their job rather than seeing it as a source of money.

1: *"My dad used to tell me you need to give an honest day's work for an honest day's pay..... When I come to work, I come to work....I believe that I should have to back into the room to pick up my paycheck....That attribute, I think helps me be successful."*

Resources

Resources available	LTF, Laying the Foundation
	STEMscopes
	Adaptive Curriculum (online)
	hands on activities
	gizmos
	UT online homework
	Google maps, TOPO maps
	PowerUp school with laptops

The teachers listed out several resources (as noted above) which supported the teaching process.

2: *"PowerUp is like every student in our school has a laptop, and we have WiFi connection, so we can use internet in classroom. We can use it for research. We can use it for online activities."*

Support from admin/teachers

Support from admin/teachers	Arranging lab materials,
	Plan together
	PLCs every week
	Common curriculum/ curriculum teacher

The teacher asserted that the administration or teachers provided extensive support to them, by way of combined group planning about the curriculum to be taught, lesson plans, organizing weekly PLCs. The teachers thus, worked as a coherent team.

2: *"Yeah, we get a lot of support from our administrative staff. Any resources we need, they always try to provide us. Any lab materials we need; they always arrange for professional developments, and we have PLCs every week, and in PLC, we discuss our lesson plans in the common curriculum with a common curriculum teacher"*

Staff Development

Staff development	Waste of time, boring
	Repetitive, happens each year
	Training to be more teacher-focused
	Teacher's feedback must be taken

Though staff development meeting or trainings were seriously criticized by the teachers. The greatest drawback was that they focused on repetitive trainings each year, without any focus on issues which actually required attention. For instance:

P4: *"I think having ways to teach students different study techniques would be a wonderful training."*

It was regarded essential to take feedback about such meetings from the teachers themselves, which was presently lacking.

Support from parents

Support from parents	Concerned about students
	Active in parent conferences

The analysis revealed that the student's parents were a great source of encouragement and support for both the students as well as the teachers. The teachers indicated that not only were they active participants in the parents-teacher meetings or conferences, but also keep a regular check on their children.

2: *"In this school, actually parents are very supportive. Most of the parents are cooperative. Most of them always keep inquiring about their students. They come by school. They attend those, what do we call it? Parent conference, parent meeting?"*

Strategies for Disabled or challenged students

Strategies for Disabled or challenged students	More engagement with Labs/Hands-on
	Motivation, appreciation
	Cooperative learning
	Extra time
	One-to-one teaching

The teachers revealed that several strategies were adopted for the special, gifted, or disabled students in the single sex schools.

An increased proportion of experimentation or hands on activities was a common addition.

2: *"I had her for two years, but she used to enjoy doing hands on, so that was one thing. I always used to include something hands on. Every day, we are working on lab. That excited her so much, and that would keep her engaged and challenging at the same time."*

2: *"Yeah, most of the students with like challenges or learning disabilities, cooperative learning is very helpful. Hands on activities."*

A Good learning environment

A good learning environment	Understanding the level of students
	Student's learning styles
	Strengths and weakness of students
	cooperative learning
	Interactive
	Project based learning (PBL)
	Independent learning even in group work
	Inculcating the urge to ask questions
	Powerful learning through Failure

The first and the foremost task identified for building a good learning environment I the identification of the varied learning styles among the students. A proper assessment has to be done by the teacher of the strengths, weaknesses, learning styles and behavior of the different students coming from varied backgrounds.

2: *"Yeah, in our classrooms, we have students with different learning styles, so when we plan our lesson, we always include—try to plan according to the learning style of the students like some students have IEP. Some others fall in the 504 category."*

Several techniques were found to be prevalent in order to allow for a conducive learning environment, such as Project based learning (PBL), Cooperative learning, etc.

2: *"One of the approaches we use is cooperative learning....Yeah, most of the students with like challenges or learning disabilities, cooperative learning is very helpful. Hands on activities."*

While, several other requirements came forward for designing good learning environment at such schools.

2: *"The interactive journal as well as the labs that are interactive, too."*

As stated by the teachers, the first step towards building a good learning environment in class, was listed out to be the urge to ask questions. Asking questions about anything and everything discussed in class, was deemed to be the first step towards the required learning environment for science in the class.

3: *"Basically in order to make the first step, you have to have a question. Question about anything. If you're eating anything. If you're watching anything. If you're looking at anything. Even the pen and the paper which you are using to study even the book you are studying, the first question. How did this book get into existence? Who invented this? Everything is what, who, how, when? All these exclamations start the basics of the science."*

Further elaborating on the need to ask questions, the teachers explained science as a gradual, step-by-step process which requires constant learning. Thereby, to create a conducive environment for science learning, the teachers revealed that the realization is a must about the science being a constant, repetitive and cyclical process of learning.

4: *"You read any historical recollection of a scientist, he observed things, questioned things, experimented, re-observed, re-questioned, so it's a cycle. They like to talk about the scientific—well the scientific method really isn't a—it's a process and it's a repetitive process."*

The analysis reveals the freedom of the students in designing their own learning process according to their own needs was given a prime importance in such schools. The teachers indicated that by doing this, they not only actively engage the students, but also ensure that they constantly learn and understand the concepts or topics in each step. The teacher was found to be playing the role of a facilitator to this learning process of the students. Thus, indicating that the teacher gave the students the freedom to speak and have an opinion of their own, by actively being interested in listening to them.

3: *"I want to see how the kids want to move. I give them a chance to make their own steps. I just help them during that process. I provide them with all the means, technology, resource, everything. Even the experimentation, the experimental lab, everything."*

Failure as reported by several teachers was an integral part of the process for powerful and long-lasting learning. It was claimed that the students needed to work on their own, think out of the box, and then learn from their own mistakes.

1: *"Sometimes, in that learning cycle I stand back, and I believe failure is a powerful learning tool because if I give you a procedure and say, "read through this." I give you everything you need to do it, and I expect you to do it, sometimes I stand back and just watch, okay. Then, I'll do a debrief. "What do you think you could have done differently? What did they do differently from you?"*

Learning from one's mistake, is thus, a crucial ingredient to success. The teachers deliberately delayed their inputs into the process of teaching, to enable the students.

1: *"Sometimes, you know you stand there as a teacher and you're biting a hole in your lip because you want to tell them what to do, but you say no they got to go through this failure here."*

Addressing learning styles

Addressing learning styles	Focus on Vocab learning
	Attention to understanding of questions
	Innovate with the blackboard
	Using various resources for the formative assessments
	Creative use of textbooks
	Engaging the students through relevance
	Experimenting with Reading and writing

The study reveals that

it was well understood by the teachers that there are wide differences among the students, and hence their learning styles, which cannot be addressed via using a single technique of teaching. Hence, a variety of different techniques were applied for catering these differences in the learning styles of disabled, special ed, disadvantaged, and certain girl students.

3: *"All the students could not be assist just by using one technique. I use various resources for the formative assessments, too. Especially for the gifted kids, for the special ed kids, I use those things."*

This marks an important point for understanding the concern of the science teachers in their associated schools, and realizing that *inequality* was a major concern recognized by these teachers. The teachers revealed that it was an important point for them to make sure that all of their students are on the same platform in class.

3: *"Then finally, I try to get them to the same point and achieve success, no matter in whatever topics I teach, whatever experiments or whatever lessons they are learning."*

Further, several techniques were followed by the teachers to ease out the process of learning, based on the varying learning style among the students.

Comprehension of the written material was a must. Focusing on reading and comprehending the question, before answering it was noted to be a major technique deemed to be essential for each student.

P4: *"Sometimes it'll say, 'All the following apply except.' Well, the first one applies so boom that was the answer. It's like, yeah, but it says, 'except.' Did you see that?"*

For this, a beginning step was identified to be the understanding and knowledge about the jargon related to the subject of science. It not only will enable the kids to comprehend the questions, text, chapters, and

other external subject-related material available online, but also enhance their conversations pertaining to the subject in class.

4: *"Vocab is important. Kids need to—especially in science. If I'm talking to you about a certain thing and I'm using a vocab and jargon that goes with the topic and you say, 'Huh?' It's like, well, that means you don't know the vocab."*

The teachers also gave a prime importance to two most important tools for their teaching, namely blackboard and textbooks.

As pointed out by a teacher, especially for teaching earth sciences, geology, geography and other related science subjects, the textbooks occupy a determinant position in the transmission of knowledge to the students.

4: *"Geology is so different today than it was when I took it. It used to be there were no pictures. Everything was black and white and lots of reading, but no pictures. Now all the textbooks have great colorful pictures so they can see stuff. That's what's so important about teaching earth science and geology is to see it."*

Blackboard, was another influential tool which supplemented the job of teaching, especially for the science teachers. It was stated that the blackboard must be used an innovative, creative and active mode for effective teaching and learning.

4: *"It's been on the board for a week and a half. You didn't read the board?...You would think that students would come in and read the board. They don't. Maybe that needs to be part of my ritual is come in the morning and read the board. Maybe erase the board and give 'em a pop quiz, what was on the board? That'd be a great warmup one day."*

Another successful way which was widely used by these science teachers, was to target the student's willingness to engage with the topic themselves, by first making them understand the relevance of a particular topic in their life. This enabled the teachers to gain the interest of the students. As asserted by one of the teachers:

3: *"The relevancy. They understand and then they think oh, it's important for us to understand the importance. Then they understand. If they understand its importance and its application in their life, then they are not going to refuse to learn it. That's the thing."*

The teachers also reported that the basic activities of reading and writing could be experimented with, and used in different combinations for students with different learning styles. Depending on the students abilities of reading comprehension and pictorial understanding, the teachers assisted their learning processes with catering to their such needs.

1: *"Well, I try to put together a learning cycle that incorporates a number of the, a number of different pieces. I know some students like to read. I'm the type of student, give me a book and I'll read it. Give me the test, I'll take the test and pass it. There's some students you can do that with. Then, there are some students that you give them the book you read it to 'em and then you show them a picture and then they get it, so I incorporate that aspect."*

Testing deficiencies in present scenario v/s earlier

Deficiencies of standardized testing	Need for both informal & formal assessment
	Some students Lack good test taking skills
	Do not represent students' knowledge all the time
	Suffer from lack of reliability due to lack of interest
	No in-depth knowledge
	Narrow down knowledge to only test syllabus
	Lack of practical knowledge, due to test curriculum

The analysis shows that the science teachers were particularly concerned about the whole concept behind standardized tests. They were apprehensive about the knowledge of students being severely limited to the particular questions which were to be asked in the upcoming test, rather than on the long-lasting knowledge of the subject.

4: *'In science...I'd rather have a student that's really interested in something that I'm not gonna test them on and talk about it, go over and make them understand it the right way than worry about what's gonna be on that test and are they gonna pass it because they have to know the one answer and then they're gonna forget it the next day.'*

It was also criticized that the test schedule required focusing on only the strict curriculum, even if the understanding of concept demanded more depth knowledge and discussion in class.

4: *"We get so off-tangent on this, but they wanted to learn it. It was something they probably should know because it's in the news. It's important. Because it's not in the curriculum, oh sorry, can't talk about that?"*

This was also found to have restricted the use of the labs, for conducting practical testing.

1: *"The requirement or the pacing of the curriculum prohibits that. It holds 'em back.....I'm just sayin' that there's a lot of draw backs to having this type of philosophy."*

Thus, it was realized that the entire purpose of learning was dissolved due to the short-sightedness of standardized tests.

Moreover, the tests were also reported to be biased, due to the lack of good test-taking skills among certain students.

2: *"Yeah. You feel that the scores may not truly reflect what the students know, all the time, because they don't really put effort in that particular standardized test."*

Alternatives to standardized testing

Alternatives to standardized testing	Daily observance must
	pre-test and post-test
	Informal assessment gives better idea of effort put in

The teachers

had several alternative ideas to the normal standardized tests which currently take place in the schools. These alternatives were found to be segregated into two main ideas; first relating to the combination of formal and informal assessment, and the second relating to the pre-testing and post-testing.

The significance and major idea of pre-testing and post-testing the students was reported by a teacher as follows:

4: *"I think what should happen is if you take an eighth grade test, give them a test at the beginning of the year. Give them a test at the end of the year. What did they learn? Did it change? Every training"*

Accountability Concerns

Accountability concerns	Teachers are accountable to some extent
	Terrible to blame teachers
	Examination structure is absurd

Regarding the issue of

whether teachers should be held accountable for student's performances, the study shows contrasting and mixed responses. While one teacher was found to be positive in response, stating that the teachers are indeed responsible for their performance up to some extent, there were others who were totally against the claim. This was majorly based on the pretense that the testing-style followed by the school deliberately forced them to focus only on the test questions, which consumed major time from their teaching schedule.

P4: *"I think it's a terrible idea. We get so wrapped up in teaching to the test that we spend what, five weeks getting ready for a test that really I think is absurd."*

SAMPLE

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