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ABSTRACT

Asserting that the ability to compare is basic to any cognitive process, this paper draws on Reuven Feuerstein's theory of mediated learning experience to guide teachers in encouraging the development of young students' spontaneous comparative abilities. Teachers are to provide students with concepts, labels, operations, and relationships to describe the similarities and differences among the stimuli they encounter. The teacher promotes students' feelings of independence and individuality by encouraging divergent responses and a flexibility in the use of attributes for comparison. The bulk of the paper is organized into two lessons for teachers: the importance and process of comparison; and mediating children's comparative activities. (EV)

TEACHING CHILDREN COMPARATIVE BEHAVIOUR USING MEDIATIONAL TECHNIQUES

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Introduction

The ability to compare is basic to any cognitive process. The need for spontaneous comparative behaviour on the part of our students in today's world is more pressing than ever before in the face of our highly technological and knowledge-based economy. Being able to compare is more than merely recognising and identifying the things we perceive. It is an essential prerequisite for establishing the relationships that lead to abstract thinking. Our students need to organise and integrate separate and distinct bits of information into coordinated and meaningful systems of thought both inside and outside the classroom.

Feuerstein and Hoffman (1995) believed that it is only when we spontaneously compare that we become modified by this experience. As we receive new information, we organise, compare, and relate it to units of thought that already exist in our repertoire. We integrate this new information into these units of thought by finding the relationships between them. If a person does not attempt to organise and elaborate separate phenomena by seeking relationships between them through comparison, his or her experience will be limited to one of mere exposure to an episode.

The lack of or impaired spontaneous comparative behaviour results in an individual's episodic grasp of reality, in which things he encounters are perceived as isolated, separate, onetime experiences. He makes little or no effort to synthesise, to seek relationships between the experiences of yesterday and today or to put together two or more sources of information. However, it does not mean that a child who does not compare spontaneously cannot do so. It is rare that a child, according to Feuerstein, is unable to compare or does not do so spontaneously in given circumstances. Even a very young child will carefully select the larger of two pieces of candy offered to him.

For many students, spontaneous comparison is limited to their most basic physical needs which are not necessarily those that are relevant to academic achievement in schools. In the classroom, when comparison is specifically called for in a lesson context, students may experience problems in responding because they lack the verbal tools needed to express their feelings or findings. Many of the differences between objects are either overlooked or not perceived because the concepts necessary for discrimination do not exist in the student's repertoire or are not readily available.

Additional difficulties may arise when the two objects under consideration are not compared using the same parameters. For example it is true that a bird has feathers and a fish has gills, but this description is not a comparison. An adequate comparison requires that the fish and the bird be judged according to the same criterion: either

skin covering (a fish has scales while a bird has feathers), means of respiration (a fish has gills while a bird has lungs) or any of the other many possibilities for identifying the similarities and differences between them. (Feuerstein, 1980).

The Teacher as a Mediator

The teacher plays an extremely important role in developing spontaneous comparative behaviour in her students. Through a mediational teaching style a caring teacher works (in most instances) one-to-one with the child to improve his ability in making accurate comparisons. Mediational teaching is based on the theory of mediated learning experience formulated by Feuerstein in the 1950s when he developed it to explain individuals' different potential and propensities for learning.

His research since then has found that individual differences in learning can be traced to the individual's exposure through mediated learning experience to his own culture. Different individuals learn and think differently via different mediated learning experiences. It has been observed that an adequate mediational teaching strategy can turn a student into an efficient learner and thinker. Students make use of their previously acquired learning experiences to confront new ones with the help of the mediator-teacher. It is through the teacher's mediation that the student gains insight into the nature and meaning of the process of comparative behaviour. Mediation is a kind of interaction that develops the basic attitudes and competence for self-directed learning and thinking.

To date, Feuerstein has identified 10 criteria or types of interaction that he believes are fundamental in mediation. The aim of this chapter is to apply his criteria to teaching an important thinking process of comparative behaviour to our students. Several techniques are suggested. For example, teachers will encourage their students' feeling of competency by increasing and enriching the repertoire of attributes to which experiences can be compared. Students are provided with concepts, labels, operations and relationships to describe the similarities and differences among the stimuli they encounter. The teacher promotes the students' feeling of independence and individuation by encouraging divergent responses and a flexibility in the use of parameters for comparison.

Many of our students in the classroom exhibit impulsivity in their behaviour and thinking. To control this impulsivity, the teacher mediates by discouraging impulsivity and encouraging responses that indicate reflection and differentiation among various parameters, and the selection of those that are most relevant. (Feuerstein and Hoffman, 1995). This involves having the student perceive and focus on two or more objects or events. To a large extent, when individuals are forced to compare, they must look for qualities they might otherwise not perceive, especially the sharpness of the elements that are perceived and the precision with which they are registered. Our students must learn how to discriminate well in life.

Discrimination both stems from and determines the nature of comparison. Certain dimensions may be overlooked unless the object is compared with another that is different in those dimensions. For example, an individual becomes aware of the relative characteristics of an object only when he or she compares it to another, since

dimensions like 'big' or 'little' and 'tall' or 'short' cannot be perceived in a single object.

Cognitive Functions

There are eight cognitive functions identified by Feuerstein as implicit in the thinking process of comparison. These are important for the teacher-mediator to know and understand and to observe in their students.

1 Clear stable perception that is not to be changed in the course of comparison.

2 Conservation of constancies and invariants so that if an object of comparison is changed, continuity of that object is retained in spite of the changes that have occurred during the process of comparison. For example, if a word appears in large print at the top of a page and in small print at the bottom of a page, it should be recognised as the same word in spite of its change in size.

3 Systematic and thorough exploration that permits an exhaustive gathering of the data required for comparison. Without scanning the total field, the input of information will be poor, imprecise, and selected at random.

4 Acquisition of labels, concepts, and operations since comparative behaviour will depend on, as well as determine, the richness of the repertoire of the dimensions used in finding and describing similarities and differences.

5 Ability to keep in mind a great number of parameters during the process of comparing.

6 Making a plan that will take into account the complexity of the tasks.

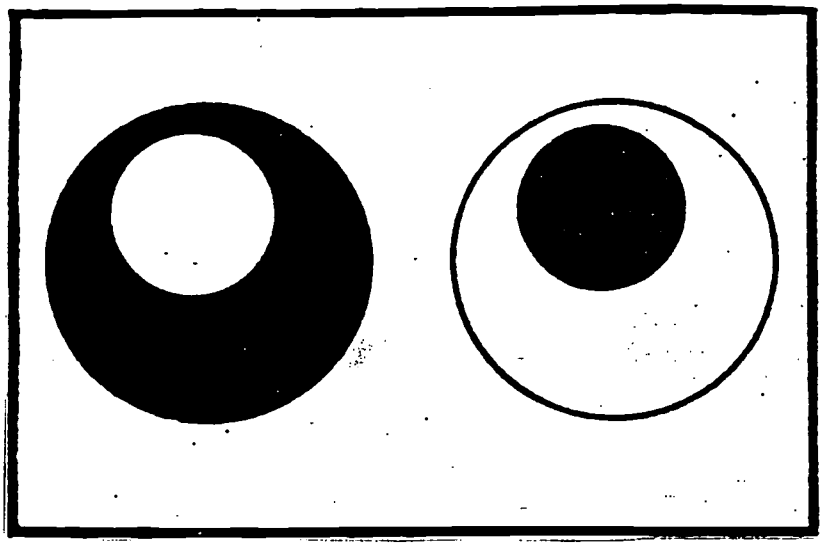
7 Use of hypothetical thinking and hypothesis testing to evaluate the alternative responses.

8 Selection of relevant cues as reference points.

The process of judging, classifying and establishing relationships is an important determinant for, as well as outcome of, comparative behaviour. The need to compare is both explicit and implicit in most school tasks. Even a question by a teacher, such as, "Is that the way to behave in class?" implies a need to compare norms of behaviour. Comparative behaviour may, therefore, be the product of an intentional, volitional and planned act on the part of the teacher or the student.

SAMPLE LESSON I (adapted from Putting Feuerstein's Programme into Practice-Cognitive Research Programme. University of the Witwatersrand. 1995)

Figure 1
COMPARISONS
OF STIMULI A & B



This lesson focuses on the cognitive operation of comparison – ie., looking for similarities and differences between items according to relevant and appropriate criteria. Feuerstein's symbol for this is two circular figures which have both similar and different attributes. By mentally superimposing one figure over the other we are able to identify which attributes they have in common and which are different.

For example, both figures in Figure 1 are circles and hence are similar in shape but have their colours located in different positions – the one on the left is white on black and the one on the right is black on white.

How is A related to B? Which is the better? Which should I choose? What decision should I make? Being able to answer these kinds of questions depends on the ability to compare. COMPARISON forms the basis of relational thinking – determining how objects, events, stimuli are similar or different. An effective comparison depends on the relevance of the criteria chosen. For example, if you want to compare cars in order to decide on which to buy, using the criterion of colour might not be as relevant as using the criterion of cost.

WHAT IS COMPARISON?

Comparison is identifying and describing the similarities and differences between objects, events or ideas, according to critical or relevant criteria. For example, if in putting together pieces of a puzzle a black square and black triangle are compared, the critical criteria for describing similarity is colour.

WHY IS COMPARISON IMPORTANT?

*to move beyond merely describing events, objects or feelings in life, by making links and meaningful connections, e.g., happy, elated and ecstatic are different intensities on the same continuum of happiness.

*to facilitate decision making by weighing up the pros and cons of an argument or prioritising criteria used when making a choice between items e.g. when choosing who to vote for, the candidate's opinions may be more important than his/her party.

WHEN AND WHERE DO WE COMPARE?

*in self-expression, e.g., by defining in what ways you are the same and different from others.

*in everyday life, e.g., by examining characteristics of food and the requirements of preparation in deciding what to cook.

*in making major life decisions e.g., choosing what career to follow, whether to get married, where to live.

*in celebrating the diversity of cultures and learning to tolerate differences in community practices.

*in developing categorisation skills, e.g., grouping things according to a common attribute.

> COMPARISON depends on the development and use of various cognitive functions e.g., when making a COMPARISON of different careers we need to take into account various factors (considering more than one source of information), in order to make a sound judgement (need for logical evidence) and systematically test job opportunities (worked through output responses).

MEDIATION in the HOME

Everyday activities in the home can be used to teach the skill of COMPARISON:

Enrich outdoor activities by extending an understanding of nature through comparing. For example compare the needs of different plants so that you know where best to plant them – whether they need lots of water or which attract more insects and birds. You can build up a scrap book with pictures from magazines and newspapers to make a table of the differences and similarities between all the plants in your garden.

Allow household mishaps to become an opportunity for creative decision making. For example, if your cake flops, generate as many solutions to the problem as possible (e.g., make a pudding out of it or cut it and ice it). Consider and compare the pros and cons of various alternatives in order to make the most appropriate decision.

Other occasions where COMPARISON can be mediated:

*card games like snap; matching pairs; happy families.
*stacking pots from biggest to smallest
*comparing products in terms of value for money
*odd one out games like: spot the wild animal from among the domestic animals.
*practise recognising opposites e.g. night/day; cold/hot; sweet/sour; hard/soft; clean/dirty; angry/happy.

MEDIATION in the CLASSROOM

Numerous classroom experiences can be used to mediate COMPARISON. These are some examples:

GENERAL
Compare and evaluate different teaching techniques; such as cooperative learning versus individual learning.
compare and evaluate different approaches to note taking; such as mind mapping versus linear point form notes.
enrich vocabulary by mediating the degrees of comparison to enable precise and accurate descriptions of objects or happenings.

LANGUAGE
Compare characters in literature according to their values, ambitions, personalities.
Compare poems according to themes, style, period, imagery
Discuss figures of speech which are based on comparison such as similes, metaphors.

HISTORY
Compare time periods in history such as stone age and iron age according to relevant criteria like life style, work tools.
Critically evaluate the particular bias of opposing political perspectives in history such as different writers' views of an event.
Compare the ideologies of different political leaders or heroes.

GEOGRAPHY
Draw comparison charts of different geographical phenomena such as weather, seasons, rocks, plants.
Discuss the structures of different types of settlements such as urban/rural.
Use graphs to compare changing conditions such as temperature, pressure.

GENERAL SCIENCE
Compare animal groups according to relevant criteria such as locomotion, reproduction.
Evaluate experiments by comparing the conditions and results of experimental and control groups
Present the arguments for and against evolution and creation.

MATHEMATICS
Use the concepts of greater than and less than to introduce comparisons in maths
Discuss the similarities and differences between multiplication and addition or division and subtraction.
Compare geometrical shapes according to relevant criteria such as number of sides, angles, properties.

ART
Encourage art appreciation by comparing techniques of different artists or different periods of art
Compare the strategies of different advertisements
Develop an understanding of music by comparing different pieces according to criteria like pitch, pace, instruments.

MEDIATION in the COMMUNITY

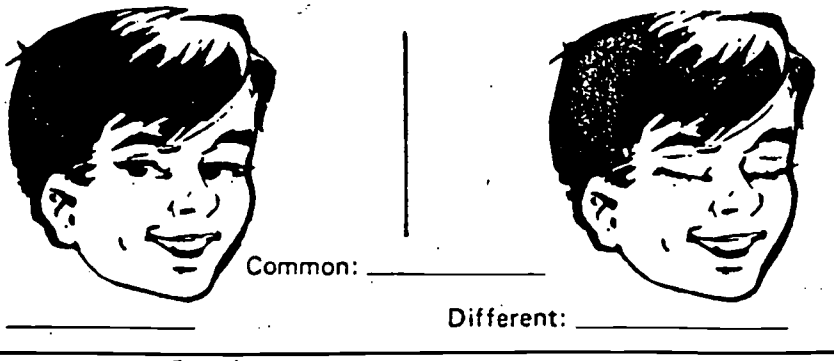
COMPARISON is a skill that can be used to promote interpersonal and affective development, enhance creativity and facilitate multicultural awareness. One suggested activity to use with students is the Cultural Treasure Chest to mediate for multicultural sensitivity.

Explore the diversity and richness of the different cultures in your group and compare them according to set criteria using a comparison table.

CRITERIA	CHINESE	MALAY	INDIAN	EURASIAN
Food				
Games				
Dress				

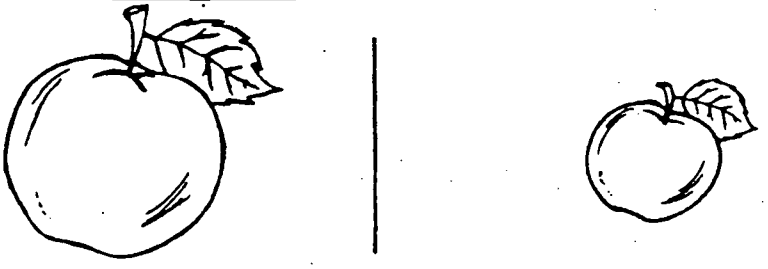
Figure 2 SIMILARITIES and DIFFERENCES in STIMULI (from Feuerstein, 1978).

Indicate what is common to each pair of pictures and the differences between them.



Common: _____

Different: _____ Different: _____



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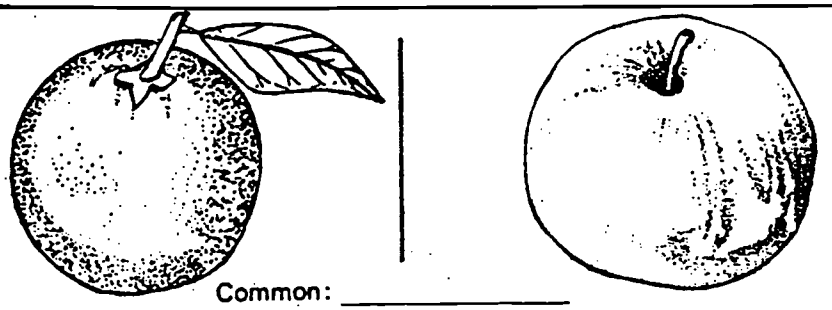

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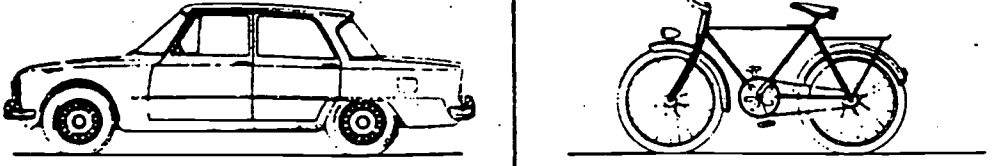

Common: _____

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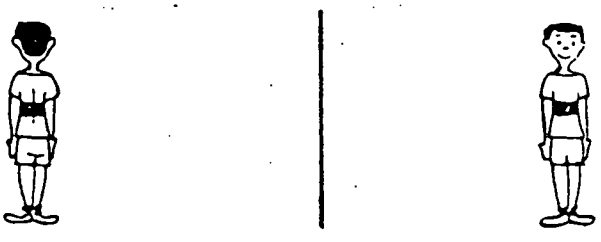

Common: _____

Different: _____ Different: _____

SAMPLE LESSON II (adapted from Feuerstein and Hoffman (1995) and Sharron (1987))

OBJECTIVES:
To find similarities and differences between two pictures
To differentiate on the basis of what one perceives and what one knows.
To describe the commonality between two objects with a superordinate concept.
To describe the differences between two objects using the same parameter.
To introduce interclass and intraclass differences
To enrich vocabulary both quantitatively and qualitatively.

VOCABULARY

Common	Include	Implicit	Relative
Exclude	Appearance	Set	Superordinate
Continuum	Differentiate	Class	Salient

MEDIATION
Mediated regulation and control of behaviour is needed for the Figure 2 tasks in which all available information must be gathered, elaborated and the response expressed in one word. The transformation that occurs between the two parts of the same task also must be mediated.

SOME MEDIATIONAL TECHNIQUES FOR THE TEACHER

Notes for Discussion:

1 A picture is a form of communicating and presenting information. We must 'read' the picture to gather information on 'who' 'what' 'when' and even 'why'. A picture is worth a thousand words.

2 We can compare the things we perceive using the following criteria: shape, figure, color, number, size, orientation, location and position.

Key Mediating Principle:
To what we see, we can add what we know and what we can infer. We can infer many things from what we know. (for example, we see an adult and several young people in a room. The young people are sitting at desks; the adult is standing next to a blackboard. We know this is a common arrangement for a classroom. We infer that the adult is the teacher and the youngsters are the students.)

Task Definitions in the Lesson

1. We define the task by reading and understanding the instructions.

2. Implicit in the task is that commonality can be described by one word- a concept- that permits generalisation and discrimination (inclusion and exclusion).

a) Common = belonging to or shaped by both items in the comparison; can be decided on the basis of perceptual or conceptual overlap (e.g., common interest, common rooms, common denominator).

b) Concept = Class of 'things' (objects, events, relations) that vary among themselves so we can tell the members apart, but are all grouped together and called by the same name.

c) Generalization = Giving the same label to a new example that differs in some way from previously met examples: making the same response.

d) Discrimination = Using a different label (making a different response) for an example that shares some, but not all, of the same properties with previous examples.

Notes on Overgeneralisation.

Comparing two objects with different attributes, such as the faces of two boys.(see Figure 2), or a car and a bike, to find what they have in common, is a task of both generalisation and discrimination. The concept, or general idea, used to express this commonality includes the objects in question, or perhaps just their attributes, while excluding other objects and characteristics.

Overgeneralisations, such as males, humans, vertebrates, are not good enough because they are not sufficiently specific: it is true that a boy is a sub-set of the above terms, but not all humans, vertebrates or even males are boys. The right superordinate concept is "boy", but not 'smiling boys' because that term could represent two specific boys, rather than the class of objects termed 'boy'. Moreover, 'smiling boys' suggests that both the boys in the pictures are exactly the same - just two smiling boys. In fact, they are different on other respects and this can be allowed for in the more general term of 'boy'.

The answer to the second task in Figure 2 is apples, not fruit or food which would be over-generalisations. The difference between the two apples needs to be expressed in two words, one of which qualifies the noun 'apple' e.g. 'small apple', 'big apple'. A principle is thus established that adjectives help to discriminate between objects in the same class (intraclass) while interclass differences are denoted by different nouns.

Comparing Differences in Attributes

Implicit in the task is that the differences should be expressed using two attributes. This can be inferred from the number of provided lines. The two words should represent different aspects of the same parameter. We can describe the bicycle in task 4 as having room for only one passenger and the car as having four wheels, but that is a description, not a comparison. We will arrive at a response by comparing and a comparison of the various attributes should read:

Car	Bicycle
Closed	open
Four wheels	two wheels
Many riders	one rider
Storage in trunks	no storage space
Horsepower	pedal power
Weighs two tons	weighs about 30 pounds or less.
Gasoline engine	pedals
Costs thousands	costs less than a thousand, unless special model.

It is implicit that the answers be short. This can be inferred from the amount of given space.

In three tasks (see below A, B, & C) we are given an object that differs from another in only one attribute. There is a constancy of the object over changes in the single attribute. Because there is only one difference, that difference is salient or it stands out in these particular tasks.

A) Task 1 : Difference: eyes open; eyes closed.

The given information is not sufficient for the inference that the closed eyes indicate sleeping. Whereas most people close their eyes when they sleep, not all people whose eyes are closed are sleeping.

B) Task 2 : Difference: size

Because we have no way of knowing the absolute sizes of the apples without weighing or measuring , we must use size as a relative measure, one in relation to the other. If we were to draw a continuum of size, the two would be on opposite ends relative to each other. In comparing only two items according to a relative attribute, we are usually content with using opposites, but we are not limited to them. Finer discrimination requires the use of gradations between the two poles. Contrast large or small things with greater precision by using the following:

Miniscule minute wee tiny small medium large gigantic enormous

Or instead of hot or cold, consider the following:

Icy cold cool tepid lukewarm warm hot burning boiling

C) Task 5: Difference: orientation (back and front)

The boy is unchanged despite the transformation in his orientation.

There are other parameters according to which apples can be compared (colour, shape, odour, taste, type, texture, firmness, blemishes, location of orchard.) but since there is no way of definitively determining these parameters from the picture, they are not appropriate here.

Commonality between two objects

The commonality between the objects of the first two tasks in Figure 2 can be seen easily because the objects belong to the same class. But for objects which belong to different classes the commonality is not visible; it is conceptual in character. So information must be gathered about both objects. This will focus initially on the differences until a level of generality is reached where a common concept discovers their relationship.

For an apple and an orange it is 'fruit', for a bicycle and a car it is 'vehicle'. This is more precise than transport which includes ships, planes or railroads that carry goods as well as people as part of their main function, and are, therefore, less personalised means of conveyance. By summing up the differences, eventually to find the common factor, we achieve the ability to say: 'They are both...'

When comparing the differences between objects in the same class, greater discrimination needs relative adjectives of gradation – vocabulary that can allow children to go beyond 'big' and 'small'. Instead, a variety of terms, ranging from 'tiny' to 'medium' to 'gigantic', can be applied to give much greater precision. In this lesson, it is important that the teacher brings out into the open the cognitive aspects that can be learnt from comparison. Many answers may be correct, but there are some answers that are better than others which are more precise, relevant and more differentiating as for example, 'tart, bitter, acidic, spicy, salty, insipid or flavourless' compared with 'tastes bad'.

Discussion of Divergent Response

The discussion of divergent responses is necessary because the tasks are deceptively easy. Objects and concepts familiar to the students have purposely been chosen so that the emphasis in the tasks will be on the process of comparison. There are many possible answers, each of which seem to be equally correct.

As an example, let us take the apple and orange comparison. There will be few students who cannot recognise and express the differences between them. Answers may be based on physical aspects such as the type of skin and its color, and the texture, taste, smell or color of the fruit. Another difference is that the orange is shown with a leaf and the apple is not. In addition, one can consider one's knowledge about the two different fruits. The two fruits can be compared according to their number of calories, vitamin content, or price. Without a specific goal for the comparison, all available information must be gathered comprehensively and as many perceptual and conceptual parameters as posible must be included.

When discussing students' responses, the best answer should be sought without rejecting any of the other answers. Without a specific goal for comparison, the labels 'orange' and 'apple' would be the best answer for the differences in the above example, since these labels denote all the respective attributes of these two fruits. It is true, however, and should be pointed out to the students, that the goal for comparison generates the parameters used in the comparison. The high vitamin C content of the

orange becomes a critical factor in selecting a fruit for breakfast, while the color of the apple may be the relevant criterion for a fruit arrangement.

It is possible that all of the students may write the names of the fruit as their answer. The teacher must then ascertain whether this common answer is a product of reflection or the result of a happy accident. The teacher may list a number of inadequate parameters and ask why they were eliminated. Students must justify their answers in this activity.

Conclusion

The above two sample lessons are to be used as guides. Spontaneous comparative behaviour can be enhanced in every lesson across the curriculum and if adequate mediated learning experience is given, this thinking behaviour will be transferred to outside the classroom, in interdisciplinary project work and unconsciously into everyday living itself.

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