Promoting Inquiry Based Learning: **Strategies in the Classroom**

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UNDERSTANDING INQUIRY-BASED LEARNING

Inquiry-based learning (IBL) thus encompasses the INVOLVEMENT of the Learner in the learning process, leading to his understanding of the key ideas. Inquiry implies the DESIRE TO KNOW or A PERCEIVE NEED TO KNOW from the part of the learner.

Inquiry-based science learning involves the pursuit of Open-Ended questions and is driven by Questions generated by learners. In IBL, the learner will learn to pose researchable questions and pursue them through open-ended investigations.

Inquiry thus involves a complex thinking process when a learner attempts to convert the information presented by the educator to useful, applicable knowledge. His understanding is often demonstrated through presenting a series of questions that have a framework, a context and a focus

All these will help the learner develop an understanding of the key topic, allowing him to synthesize new knowledge from this understanding ('internalising' the knowledge)

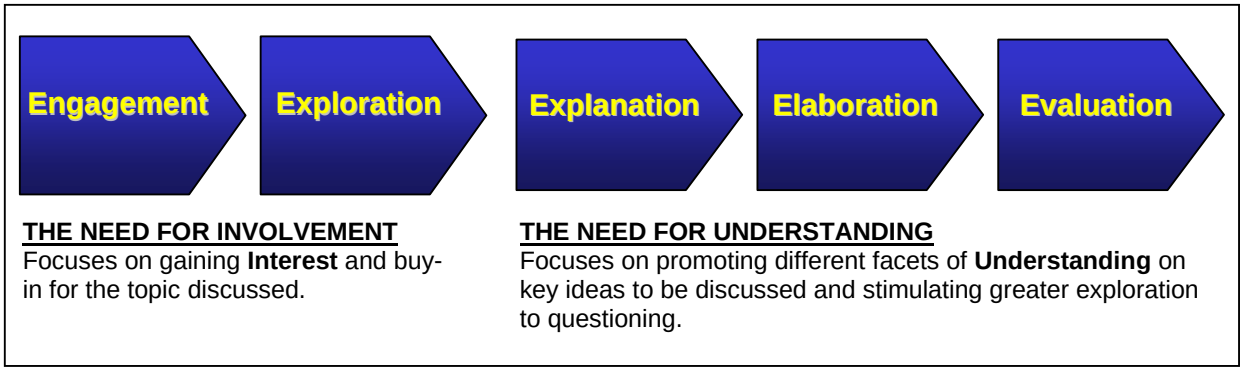
IBL is thus A Curriculum Development and Delivery System that recognises to need to INVOLVE the learner and facilitates UNDERSTANDING.

KEY ATTRIBUTES OF INQUIRY-BASED LEARNING

Given that IBL requires an active **involvement** from the learner and the promotion of **understanding** on key ideas, we have broadly included two major requirement of a successful IBL curriculum:

a. The Need to Involve the learner
b. The Need to promote Understanding from the learner

For the purpose of this discussion, we propose a modified 5Es Model for science IBL. As shown in the diagram below, this model comprises of 5 stages, which could be broadly grouped to fulfill both principle requirements of IBL: the need to Involve the learner and the need to promote Understanding from the learner, through



Involving the Learner

A Learner only wishes to be involved in the learning process when he is genuinely interested in the learning experience. The basis for involving the learner therefore rests on the need to **motivate and engage** the learner in the key idea to be discussed.

Whilst in the ideal scenario, a curriculum could be designed and implemented to suit the learning interest of each individual, in practice, the educator could attempt to **align the interest of his students** in the classroom, through the creative application of various teaching resources and the appropriate alignment of learning experiences.

There are many ways to achieve this outcome. For illustration purposes, we will describe the following methods that have been shown to be highly successful in engaging the learner to find out more on the topic to be discussed:

a. **Adopting a Thematic Approach to integrate various disciplines.** Using themes allows the educator to integrate various disciplines in a seamless and highly engaging fashion, thus allowing the learner to appreciate the interconnectiveness of different disciplines in any given topic. An extension of this approach involves the **dramatization of concepts** and scenarios to involve the students at the beginning of the lesson, facilitating 'buy-in' for what they are about to learn.

b. **Using Authentic Examples to illustrate the concept.** Using authentic examples can be highly effective in facilitating the learner's association of any given concept to his daily life. This is often integrated in a thematic setting to facilitate development of important facets of understanding such as *application, perspective and empathy* (see section on Promoting Understanding).

c. **Initiating the lesson with an engaging demonstration.** One of the advantages that surround the teaching of science is involves the ability of the learner to be engaged by observing an interesting phenomenon that exists in nature. Abstract concepts such as the various properties of air can be readily demonstrated to the students in the laboratory without using highly sophisticated instruments. Once the learner views the phenomenon with wonderment and awe, helping him understand the underlying concepts can be done with ease.

d. **Using interactive teaching materials (I-Board).** Our experience with students aged 6 to 17 have revealed that when information is presented to them in a highly interactive fashion through the computer or the use of the I-Board (an interactive whiteboard), they become highly engaged in the process of learning, making the process highly enjoyable for both the educator and learner.

e. **Hands-on Activities.** Science lessons involve a great amount of experimentation to "discover the truth" of different naturally occurring phenomena. These activities, when structured as important means to help the learner achieve a certain objective and coupled with a skillfully-designed set of questions, can be highly effective in promoting interest and more importantly, understanding in the topic to be discussed.

Promoting Understanding

The Key Facets of Understanding

A learning journey cannot be restricted to the assimilation of techniques per se. It is therefore essential to ensure that learners be empowered with the **UNDERSTANDING OF THE RELEVANT CONCEPTS.** Students should thus be challenged beyond knowledge of facts but knowledge of why and how overlaid with proper reasoning and well-supported with appropriate evidence. This, in turn could be demonstrated by the participants in the following six facets of understanding as proposed by Wiggins & McTighe (1999) [1]:

a. **EXPLANATION:** Gaining deep and broad **knowledge** of theories to justify observable phenomena

[1] Jay McTighe & Grant Wiggins; (1999); Understanding by Design; Association for Supervision and Curriculum Development

b. **INTERPRETATION:** Demonstrating ability to provide **meaning** from the data provided.

c. **APPLICATION:** **Applying** the knowledge of concepts discussed effectively in new situations and contexts.

d. **PERSPECTIVE:** Able to provide **critical and insightful** views on various issues to that surround the key idea discussed.

e. **EMPATHY:** Demonstrating the ability to **understand another person's point of view,** especially when discussing socio-ethical issues that surround the modern application of some of the concepts discussed.

f. **SELF-KNOWLEDGE**: Demonstrating understanding of one's ignorance in understanding and how one's personal experience and thought patterns could influence his understanding of matters

The 16 Habits of Mind[2]

A Habit of Mind could be broadly defined as the characteristics of what an intelligent person may do when confronted with problems to which the solution may not be apparent. While attempts to categorize these habits, one needs to appreciate that the main purpose of this exercise is to help us better understand some of the observable behaviours of a learner when he confronts a problem, thus helping us to readily determine if he has understood the concept.

Habits of Mind are seldom performed in isolation --- a learner will typically display a cluster of habits when confronted with any given problem. In the same way, each Facet of Understanding (see previous section) can be accompanied by a display of more than one Habit.

The 16 Habits of Mind are:

1. Persisting
2. Managing Impulsivity
3. Listening to others --- with Understanding and Empathy
4. Thinking Flexibly
5. Thinking about our Thinking (Metacognition)
6. Striving for Accuracy and Precision
7. Questioning and Posing Problems
8. Applying Past Knowledge to New Situations
9. Thinking and Communicating with Clarity and Precision
10. Gathering Data through All Senses
11. Creating, Imagining and Innovating
12. Responding with Wonderment and Awe
13. Taking Responsible Risks
14. Finding Humour
15. Thinking Independently
16. Learning Continuously

In the following section, we will attempt to relate each Facet of Understanding to corresponding Habits of Mind.

Relating the Facet of Understanding to the Habit of Mind

A cluster of Habits of Mind is usually displayed when the learner demonstrates a certain Facet of Understanding. The following table describes how each Facet of Understanding may be accompanied by a tentative display of a variety of Habits of Mind:

[2] Costa, A and Kallick, B (2000) Habits of Mind: A Developmental Series; Association for Supervision and Curriculum Development

Facet of Understanding	Predominant Habits of Mind	
EXPLANATION	• Persisting • Striving for Accuracy and Precision • Applying Past Knowledge to New Situations • Thinking and Communicating with Clarity and Precision	• Gathering data through All Senses • Responding with Wonderment & Awe • Taking Responsible Risks • Learning Continuously
INTERPRETATION	• Persisting • Striving for Accuracy and Precision • Managing Impulsivity • Listening to Others --- with Understanding & Empathy	• Questioning and Posing Problems • Thinking and Communicating with Clarity and Precision • Gathering data through All Senses • Responding with Wonderment & Awe
APPLICATION	• Persisting • Striving for Accuracy and Precision • Thinking about our Thinking (Metacognition) • Questioning and Posing Problems • Applying Past Knowledge to New Situations	• Creating, Imaging, and Innovating • Responding with Wonderment & Awe • Taking Responsible Risks • Thinking Independently • Finding Humour
PERSPECTIVE	• Managing Impulsivity • Listening to Others --- with Understanding & Empathy • Thinking Flexibly • Questioning and Posing Problems	• Gathering data through All Senses • Creating, Imaging, and Innovating • Thinking Independently
EMPATHY	• Managing Impulsivity • Listening to Others --- with Understanding & Empathy • Thinking Flexibly	• Gathering data through All Senses
SELF-KNOWLEDGE	• Managing Impulsivity • Listening to Others --- with Understanding & Empathy • Thinking Flexibly	• Thinking about our Thinking (Metacognition) • Questioning and Posing Problems • Thinking Independently • Finding Humour

Facilitating Understanding in seemingly complex concepts:
Dynamic Lift Thinking

Lift Thinking is an instructional method developed for the purpose of helping our students children understand the key ideas put to them, regardless of discipline and perceived academic level. Our starting premise has been that the learner's ability is not determined by the "level" of knowledge at which we think he is at but on the potential of that person to understand almost every key idea that is put to him.

In Dynamic Lift Thinking, knowledge is "lifted" from that of the learner. The method involves providing stage-wise steps and progressively guiding the learner towards gaining supporting knowledge on which he or she will derive each principle to be imparted to him. In this model, knowledge is derived, not acquired**;** knowledge is synthesized by the learner and not "passed down" from the teacher. Lift thinking is practiced extensively throughout our science programmes in partnership with schools in Singapore and the region and we believe that it promotes students' understanding in a manner quite unlike many other approaches.

USING IBL TO TEACH THE MODERN LIFE SCIENCES: A CASE EXAMPLE

The Amdon Group was honoured to have partnered Ekamai International School (Bangkok) to implement two Summer Camp programmes in 2003 and 2004 for students aged 10 to 17 years from various international schools. The programme was accredited by the Ministry of Education (Thailand) for implementation in International Schools. Using this case example, we will attempt to describe how we have structured the programme to facilitate authentic performances in the learning process.

The following strategies were adopted in delivering the Life Sciences Summer Camp programme at the school:

a. Structuring the programme into various **themes** that effectively integrates the different elements of the Life Sciences.
b. Providing extensive **hands-on experiences** through experimentation in microbiology, genetic engineering, DNA-based technologies and bioinformatics to ensure build competence and confidence in these hands-on techniques.
c. Using **custom-designed worksheets** and workbooks together with a suite of **interactive learning aids** to help the students assimilate the concepts in a highly logical manner. The i-Board® was used to engage the learners and communicate seemingly complex concepts throughout the course.
d. **Dramatizing real-life scenarios** as part of our efforts to help the participants gain perspectives on selected socio-ethical issues that surround this field, and **facilitating the discussions** by students to achieve this learning outcome.
e. Providing opportunities for **authentic application of life sciences concepts** through in-house research and development experiences as a platform for the students to add authentic value to society. The students in this programme were encouraged to undertake such research activities and present their key findings in a **regional life sciences conference** organized by our group of companies annually. We believe that such opportunities to share with their peers who have similar learning experiences, is instrumental in helping them gain deeper a understanding on the relevance of the modern life sciences in society today.

In this manner, the following facets of understanding in the life sciences concepts were demonstrated:

a. *Life sciences experimentation and research work* allowed for the assimilation of **Knowledge** of Life Sciences theories to justify observable phenomena and provided the opportunity for students to draw **meaning** from the data they got from each experiment. Each experiment was accompanied by a set of delicately crafted questions to challenge the learner to develop his understanding on why and how certain phenomena have taken place in the course of the experiment. Developing and testing of hypothesis is a frequent activity in the life sciences laboratory.

b. *The dramatization of selected scenarios* encouraged the **application** of knowledge of life sciences concepts effectively in new situations and contexts. Students were challenged to apply what they have learnt in the laboratory to justify their course of action, for example, when they role-played lawyers in a courtroom scene over forensic evidences. Such platforms also encouraged the learner to develop **perspective** and provide **critical and insightful** views on the application of a certain life sciences

technology and its implications in human life styles in developing countries, for example. In another series of debrief discussions conducted during the Summer Camp at EIS, the students realized that the same issue was valid from both sides of the argument a lack of information by the judge could result in drastic consequences.

c. *A discussion on the introduction of genetically-modified crops into India and how it would affect the livelihood of farmers in India, for example also facilitated the development of* ability to **empathize or understand another person's point of view**. This, in turn, resulted in the development of **self-knowledge** of one's ignorance in understanding and how one's personal experience and thought patterns could influence his understanding of matters at hand.

CONCLUSION

We believe that an Inquiry-based learning approach is instrumental in help educators today to teach less and students learn more. Whiles the examples presented in this paper have been restricted to life sciences and technology contexts, we believe that the instructional and curriculum design models suggested in this paper could be applied to helping educators refine their curriculum in this exciting era. We look forward to opportunities to collaborate with more educators in the region.