

A Conceptual Process Driven Framework for Developing Affinity in Students Studying At Secondary School towards Mathematics

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Abstract:

Today's hyper competitive world demands application of mathematical skills at various levels. For example, students studying at secondary level grade are required to understand and apply various mathematical concepts in solving various problems related to surface areas, mensuration, and trigonometry. Probability theory and the like. Various studies conducted by researchers have highlighted that students, face difficulty in understanding and applying basic concepts in solving mathematical problems which are commonly used in day to day operations. This papers is an attempt to develop a process driven conceptual framework for developing interest amongst the students in understanding and applying the various techniques required in solving the problems. The design of the paper follows a structured approach comprising of scoping the topic, review of literature and the analyzing the gap and developing the framework to arrive at the index which will demonstrate the degree to success achieved in developing the interest in the students. The index so determined will help the authorities in knowing the amount of effort required to develop action plan to improve the index.

Key Words:

Process, Mathematics, Framework, Interest

Introduction

The business world of today is undergoing transformation at a tremendous pace. The advent of information technology has ensured that data *and hence* mathematics is going to rule the world for a considerable period of time in the *form of* Data analytics, Data warehousing and Data science and the like. The focus has now shifted to the application of fundamentals concepts of mathematics and statistics *so as to seek out* the best option amongst the available choices in the form of data. In other words, every one of us is required to apply rational decision making techniques by using the data so as to solve the problem. Though information technology is able to provide various means and avenues to play with the accumulated data yet it has generated another picture which is not so encouraging. Students of secondary level are turning away from the subject mathematics and are developing a somewhat apathetic attitude towards subjects which involve rational thinking and application of data (Academic zone, 2015).

In order to address the growing concern amongst the students, various educational institutions across the country have started to take remedial measures in the form of coming out with some innovative solutions to ensure that the students develop an affinity towards

the subjects which involve the application of rational skills including mathematics which is responsible for integrating data and the basic concepts in solving the problems. Some of the measures adopted by the educational institutions include conducting extra classes and giving individual attention to the students so as to determine the reasons as to why students are turning away from the subjects which involve the application of rational thinking techniques. At the individual level some of the teachers are coming out with innovative solution *such as* making the students aware of the application of mathematical techniques in various operation so as to generate interest amongst the students. While the success of these innovative measures is very low yet the problem remains at large and is rapidly increasing.

Studies conducted by various agencies from time to time have highlighted some of the reasons for thus problem. These are enumerated below

- The syllabus of the subjects has not kept paced with the changes in the technology. Thus, while the students study the application of concepts in the classroom they are invariably, exposed to various information overload leading to attention deficiency syndrome. In other words, the students rely more on the Internet for doing tasks which are not interlinked to their main objective of understanding and applying decision making skills..
- Today, the students have an access to the internet which provides the solutions to various mathematical problems being taught in the class. This has resulted in the development of an attitude that has shifted the focus on copy and paste culture rather than understanding the solution to the problem
- The internet revolution has ensured that mankind and specifically t he student community spend maximum time on the internet in the form of chatting, messaging and communicating with one another. As result, the students *are being groomed* to live in virtual world instead of living in the real world *wherein* they are required to apply their cognitive skills including mathematical skills

The above points highlighted some of the reasons which deter the students from developing an apathetic attitude towards mathematics, the authors of the paper interacted with some of the teachers as well as the students, of various educational institutions to understand as to why the students turn away from important subjects. The following are the findings.

- Outdated and improper syllabus is the greatest contributor towards the development of an apathetic attitude. The curriculum should be developed in the increasing order of the difficulty and should be graduated according to the requirements of the higher education as well as the aptitude of the student
- The teaching methodology needs to be changed and should include more of the practical concepts as well as to how these practical concepts will apply in different scenarios
- Change in thinking approach is required. This is one of the most important point which has come out during the interactions. The teaching methodology is routine and the same means and mechanisms are adopted to teach mathematics to the students. This fails to generate interest and hence development of a negative attitude towards mathematics

Objective

The prime objective of this paper is to develop a conceptual framework which will address the issues related to the development of an apathetic attitude towards mathematics as well as other subjects wherein cognitive skills are needed. The students targeted include those who are studying at secondary level and are due to appear in their public examination. With the implementation of this framework, the authorities are able to determine the contribution of the deterring factor and hence come out with an action plan to ensure that the student is able

to develop interest in mathematics. The framework, at the end generates an index which will display the degree of abhorrence towards the subjects.

Literature Review

People have an innate urge to demonstrate the learnings of their skills or experience and are always seeking out opportunity to display the same (Delle Fave & Massimini, 2005). In other words, the personal skills are aptly utilized to show to the world. These activities or opportunities which are denied to the people, to an extent generate frustration and the development of an apathetic attitude towards the object which was initially responsible for generating the feeling of satisfaction (Hassel & Lourey, 2005). In an academic institutions an individual can find students who are low achievers, bored with the subjects which are being taught and feeling of despondency and future is appears to be not so exciting with the current academic life which they are pursuing (Fredricks, Blumenfeld, & Paris; 2004).

Apathy of students is a phenomenon which complex and complicated as it involves several stakeholders who directly or indirectly impact the personality of the student. To the extent the student fails to demonstrate his personal skills which gives him feeling of being important, the process of decreasing enthusiasm towards subjects which require cognitive skills becomes all the more profound.

Research & Design Methodology

The paper is designed in a structured manner. It starts with defining or scoping the basic terms on which set the objective of the framework. It then moves to the process of identification of core parameters, which are widely used in developing an interest. These parameters are selected on the basis of criterion *which will be highlighted* during the progress of the paper. Finally the framework proceeds towards generating an index based on the cumulative effects of these combined parameters. In future, hedonic pricing mechanism may be implemented to include the contribution of various factors in determining the index.

The process of generating the framework

The first step in defining the framework is the identification of the core parameters as depicted in Table 1 below.

Main Parameter	Sub Parameter	Definition	Why this parameter for inclusion in the criterion for employability	Visible / Demonstrable indicators	Weightage
Thinking skills					
	Thinking in terms of relationships	This means that the student is able to link determine the linkage with day to day operations	This is the core parameter in the application of mathematical skills as it involves linkages	The student is able relate the problem with day to day activities.	25%
	Initiative	Readiness and ability in initiating action	This parameter demonstrates the presence or absence of skill in challenging the status quo; to think differently at the situation; issues and identify the improvement processes etc.	Questions more focused on Why? Such as Why the color of hats worn by staff members is Green / yellow? Why this process? Why the management is maintaining the	25%

				status quo etc.	
Analytics					
	Understanding skills	to assign a meaning to; interpret:	This parameter demonstrates the tendency of the individual in understanding issues; documents; memo's etc.	Questions focused more on What? i.e. more on refining the issues; eg What is meant by requirements; what is the scope of this requirements	20%
Planning					
		A scheme or a method of doing allocated or designated tasks	Planning prepares oneself to take CONTROL over the activities of the designated or allocated work and reduces execution time for associated activities.	The way the student has approached the allocated / assigned tasks such as the problem of using trigonometry to determine the height of the balloon which is moving at a particular speed	15%
Available data usage					
		Understanding, using and applying the available data in the context of the given problem	With metrics, greater CONTROL over the activities is exercised in the sense that it assists in FOCUSING the direction of the assigned tasks in terms of time, resources, cost etc.	The student has identified and has made use of various data in the allocated tasks	15%

Note: Worth mentioning, the above parameters are not fixed, some more of them can be included and correspondingly the weight-age can be allocated.

Having thus obtained the basic structure of framework, we can now deliberate on this further supported by various concrete examples on each of these parameter and the generation of an index.

Employability Index

Name of the Student	Roll-Number	Year	Class
Mike Stanley	IFB09987	2010-2012	X-B
Evaluated By: / Verified by	Graham		
Employability Index			

Thinking Skills	Demonstrable indicators during 2010-2011	Rating out of 10 (1 being lowest)	Remarks (to be given by Evaluator / verifier after going through informal sessions / record verification of several activities)
<ul style="list-style-type: none"> Thinking in terms of relation ships 	Assignment Report on Uses of Probability theory in day to day operations <ul style="list-style-type: none"> Too Many mistakes on the application of basic concepts of probability Calculation mistakes due to careless 	5/10	Need to focus more on application of concepts
<ul style="list-style-type: none"> Initiative 	Provided a new method of solving the problem by referring to the internet and applying the same into the given problem <ul style="list-style-type: none"> New method / techniques Application of this new techniques 	7/10	Improved thinking skills can be developed by solving more such problems
Analytics			
<ul style="list-style-type: none"> Understanding skills 	Given problem / assignment was analyzed in detail. <ul style="list-style-type: none"> Questions were asked and were focused such as What is meant by What is the main problem 	8/10	Strong analytical tendencies
Planning	The student understood the problem first by analyzing and planning what needs to be done	7.5/10	Strong case for increasing the analytical skill further
Available Data	Data was inappropriately used for solving the problem	4/10	Need to improve more on this aspect

Index:

Index = $\sum \text{rating} \times \text{weight-age} / \text{number of parameters.}$

Thus in the above sheet we have the following index

$$\text{Index} = (5 \times 0.25 + 7 \times 0.25 + 8 \times 0.2 + 7.5 \times 0.15 + 4 \times 0.15) / 5 = 1.265 \approx 1.3$$

Now this index can be further used to take actions. Worth mentioning that we can modify the number of parameters, increase or decrease the weight age of these parameters depending on the requirements and other factors pertaining to the changes in the syllabus

Based on the above Index sheet, let us now turn towards the process of defining and implementing the quality process

Quality Management Processes for making students develop an attitude towards mathematics

Having developed the framework, in which the key components are identified, let us now move towards the process of developing the processes which address the above parameters.

A quality processes in general, follow ETVX model that is for documenting the processes, we have **Entry, Task, Verification & Exit** methodology.

Entry means or signifies the point at which this process enters the main stream. Task refers to the identified tasks that are to be performed while executing this process, verification refers to the process of checking that entire activities of the processes have been completed to satisfaction. Exit refers to when can we say that the process is complete.

Let us take a concrete example to document the process based on ETVX model.

The process that will be discussed is **initiative** process

Process Name: Initiative Process

Introduction: This process is used to focus on the key parameter for identifying whether the student possesses or demonstrates or volunteers for initiation various tasks that are assigned to him / her

Scope :

The scope of this process covers the activities, assignments, case studies that is any tasks which is a part of the curriculum as well as any tasks assigned by the institute.

Role & Responsibility

Student:

- To ensure that the work is assigned to him
- To ensure that he is regularly in touch with mentor, teacher incharge
- To clarify all the doubts related to the assigned tasks

Mentor / Teacher incharge

- To note down in specifically designed sheet the initiative activities performed by him / her in specific details as possible
- To update the sheet regularly without letting the students know the rating

Entry:

This process begins as soon as the task is assigned to him / her as defined in the scope

Task:

- The student is advised to be in touch with the mentor, teacher incharge or to whomsoever he / she may be reporting
- Thoroughly understand the assigned task / assignment given to him / her
- Note down or jot down the points of concern
- Plan your work in specific details as possible.
- Identify and define the various metric parameters related to the work
- Plan ahead and discuss the same with your mentor

Verification

Various initiatives have been documented in appropriate log sheets

Exit

Assigned task completed successfully or remained incomplete due to paucity of time

The above is an example of a quality management processes. In the same manner, processes are to be defined for each of the parameter.

Once these processes are documented they are required to be implemented by the institutes with firm support of the management. Only then this will prove to be effective. But if it is implemented in right earnest, it will provide a magic wand to the institute.

Conclusion & Future implications

Thus, the authors have been able to identify, define the core parameters which are responsible for developing an aptitude in the students towards mathematics or cognitive subjects. Further, with the core parameters, the authors have developed a framework with appropriate weight ages. By suitable modification, the school is able to include / exclude parameters as well as provide the ratings which they feel are appropriate in the given context. The school can take the assistance of other experts in arriving the weightages to be assigned as well the general capability and level of students. Thus, in future this can prove to be a rigorous framework for school to capitalize upon.

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